FACULTY OF ENGINEERING AND TECHNOLOGY

REGULATIONS 2015

CHOICE BASED CREDIT SYSTEM

DEGREE OF BACHELOR OF TECHNOLOGY

(EIGHT SEMESTERS)

(Applicable to the batches admitted from July 2015)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i. "**Programme**" means Degree Programme, that is B.Tech. Degree Programme.

ii. "**Discipline**" means specialization or discipline of B.Tech. Degree Programme, like Civil Engineering, Electrical and Electronics Engineering, information Technology, etc.

iii. "**Course**" means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics etc.

iv. **"Head of the Institution"** means the Dean of the Institution who is responsible for all academic activities of that College/Institution and for implementation of relevant rules of these Regulations.

v. **"University"** means Bharath Institute of Higher Education & Research (BIHER)

2.0 PREAMBLE

The 'Outcome Based Education (OBE)' Process is introduced to ensure that the required outcomes (knowledge, skills and attitude / behavior) are acquired by the learners of a programme. With the OBE process in mind, our educational system for the Faculty of Engineering and Technology has been framed to provide the needful scope for the learners through the Choice Based Credit System (CBCS) that will pave the path to strengthen their knowledge, skills and attitude / behavior. The CBCS offers flexibility to learners which include large number of electives, flexible pace for earning credits and audit courses.

2.1 THE OBJECTIVES OF CHOICE BASED CREDIT SYSTEM (CBCS) :

- To offer the right blend of Core, Humanities & Social Sciences, Engineering Sciences and Basic Science courses to facilitate the learners to acquire the needful outcomes.
- To facilitate students to choose open electives of their choice to acquire knowledge in the areas of their interest.
- To elevate the level of knowledge, skills and attitude/behavior on par with the students across the globe.

- To offer programmes in an open student centric environment with purpose, needful foundations, breadth (exposure for optimal learning) and professionalism.
- To learn at students' own pace
- To opt for additional courses and achieve more than the required credits
- To opt for interdisciplinary approach for learning
- To opt for Inter college/University migration within the country and outside with transfer of Credits.
- To have more scope to enhance students skills and more scope of taking up projects and assignments, vocational training, including entrepreneurship.
- To improve the job opportunities of students
- To enable potential employers assess the performance of students on a scientific scale.

The curriculum and syllabi for B.Tech programmes confirm to outcome based teaching-learning process based on the following Programme Educational Objectives.

2.2 PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: PREPARATION:

To provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the chosen field of Engineering and Technology.

PEO2: CORE COMPETENCE:

To enhance the skills and experience in defining problems in the appropriate field of Engineering and Technology, designing, implementing, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:

To enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

PEO4: SKILL:

To provide Industry based training for developing professional skills and soft skills such as proficiency in languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS:

Apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

In general the following Program Outcomes have been identified and the curricula have been structured in such a way that each of the courses meets these outcomes. The Programme Educational Objectives and Programme Outcomes are well defined and aligned with the Vision and Mission of each of the Department and the University.

2.3 PROGRAMME OUTCOMES (POs)

Engineering Graduate will have

a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.

b) The ability to identify, formulate, and solve engineering problems

c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d) The ability to design and conduct experiments, as well as to analyze and interpret data

e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

f) The ability to apply reasoning informed by the knowledge of contemporary issues

g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

h) The ability to understand professional and ethical responsibility and apply them in engineering practices

i) The ability to function on multidisciplinary teams

j) The ability to communicate effectively with the engineering community and with society at large

k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

l) The ability to recognize the need for, and an ability to engage in life-long learning

3.0 ADMISSION

3.1 Candidates seeking admission to the first semester of the eight semester B.Tech. Degree Programme: shall have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III for Engineering group of courses and Physics, Chemistry and Biology for Bio group of courses (Industrial

Bio Tech, Bio-Informatics, Genetic Engg and Bio-Medical Engg) or any examination of any other University or authority accepted by the Board of Management of University as equivalent thereto.

3.2 The candidates who have passed the Higher Secondary Examination (Vocational groups in Engineering/Technology) of the Government of Tamil Nadu, shall also be eligible for admission to the first 1st year programme.

3.3 The candidates who have passed the Diploma in Engineering / Technology, after passing 10th standard of school education conducted by the State Board of Technical Education and training, shall be eligible for admission through Lateral entry system to the third semester of the B.Tech. Degree Programmes

3.4 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Board of Management of University and UGC from time to time

4.0 STRUCTURE OF PROGRAMMES

4.1 Every Programme will have curricula with syllabi consisting of theory and practical courses.

The curriculum is structured to achieve the Programme Educational Objectives (PEOs) and the corresponding Programme Outcomes (POs).

4.2 The syllabus for each course is designed based on Course Objectives and Course Outcomes (COs). COs are mapped with the POs in order to ensure the respective PO

4.3 Outline of Choice Based Credit System:

a. **Humanity and Social Studies:** Generally a course in language, value education, Personality Development, Environmental Sciences and Ethics.

b. **Basic Sciences:** Foundation courses like Maths, Physics, Chemistry, and Biology required to understand the Engineering Courses.

c. **Engg Sciences:** Foundation courses like Basic Civil, Mechanical, Electrical, Electronics, Computer and Cell Biology to lay foundation to understand the core and other allied engineering & technology courses.

d. **Professional Core Courses:** Courses which should compulsorily be studied by a candidate as core requirement are termed as Professional Core courses.

e. **Core Elective Courses:** Generally a course which can be chosen from a pool of courses for specializing in a specific area within the discipline/domain of the core curriculum.

f. **Non Major Elective Courses:** a course which can be chosen from a pool of courses supportive to the discipline or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill.

g. **Open Elective Courses:** a course that would improve his/her employability such as advanced technology courses offered by the industries or a course which the student thinks that would add value for his/her career.

h. **Projects & Research:** Project work/Dissertation and Term paper, Internship, Technical Seminar and Comprehension.

Course Work – Subject Area	Credits		Suggested Distribution of Credits
	Minimum	Maximum	
Humanities and Social Sciences(HSS): Soft skills, Value Education & Professional Ethics, Languages, Aptitude, Personality Development, NCC/NSS/NSO/ Yoga etc	16	20	18
Maths &Basic Sciences(BS): including Maths, Physics, Chemistry, Biology and Environmental Science	26	40	32
Engineering Sciences (ES): Basic Civil Engg, Electrical Engg, Mechanical Engg, Electronics Engg, Computer, etc.	17	20	18
Professional Core (PC) & Core Electives (CE): subjects under Core Engg, relevant to the chosen specialization/branch	89	105	97
Non Major and Open Electives (NE & OE): relevant to the chosen specialization/branch, other Technical, emerging subject areas, etc.	12	15	15
Project Work & Research (PR): includes Project work, Term Paper, Seminar and/or internship in industry or elsewhere, etc.	13	18	15
Total credits for whole programmes:	161	218	195 Credits

4.4 The details of credit allocation are given below in the **Table**

Nature of the Course	Periods / Hours per Week	Credits
Theory	3	3
	4	4
Laboratory	2 or 3	1
Theory + Laboratory	2 + 2	3
Tutorial	2	1
Mini Project1	2	1
Term Paper	4	2
Tech Seminar/Industrial Training (2 weeks)	2	1
Project Work (Eighth Semester)	18 (Minimum)	9

Mini project, Technical Seminar and Industrial Training are also given 1 to 2 credits depending on the amount of time allotted based on the specific requirement of the branch concerned.

4.5 Each semester curriculum shall normally have a blend of theory courses not exceeding **7** and practical courses not exceeding 4. The students are permitted to register for a minimum of 16 credits and maximum of 30 credits in a semester.

4.6 For the award of the degree, a student has to earn certain minimum total number of credits specified in the curriculum of the relevant branch of study. The minimum will be between 195-200 credits depending on the branch of study.

4.7 The medium of instruction, examinations and project report will be English, except for courses on language other than English.

5.0 DURATION OF THE PROGRAMME:

5.1 The minimum period for completion of the B.Tech Programmes for HSC (or equivalent) candidatesshall be eight (8) semesters/four (4) years and a maximum period of twelve (12) semesters/ six (6) years.

5.2 The minimum period for completion of the B.Tech Programmes (Lateral Entry) shall be eight (6) semesters/three (3) years and a maximum period of twelve (10) semesters/ five (5) years.

5.3. In exceptional circumstance a further extension of two more semesters/one year shall be granted. During the extended period the student shall be considered as a private candidate and also not be eligible for ranking.

5.4 Each semester shall normally consist of 90 working days with 450 hours. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught. End –Semester Examination will ordinarily be at the end of each semester.

6.0 ATTENDANCE REQUIREMENTS FOR COMPLETION OF THE SEMESTER

6.1 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester:

6.1.1. Every student is expected to earn at least 75% attendance.

6.1.2 However, a candidate who could secure attendance between 65% and 74% only in one particular semester due to medical reasons (hospitalization / accident / specific illness) is given exemptions of 10% of attendance on production of Medical Certificate.

6.1.3 Students who go for participating in Seminar or Conference will be given on duty permission. The candidate shall submit the on duty participation certificate to the HOD who will in turn recommend and submit to the Head of the Institution for the approval. The approved certificates will be forwarded to the Controller of Examinations for record.

6.2 Candidates who do not satisfy the clauses 6.1.2 and 6.1.3 will not be permitted to write the End-Semester Examinations of the subject and are not permitted to go to the next semester, the detained semester should be repeated in the next academic year. When a student fulfills the requirement of overall attendance in a semester as per the clause 6.1.2 and 6.1.3 but fails to fulfill the attendance requirement for some of the courses, such courses should be repeated in the next academic year when offered.

7.0 CLASS ADVISOR AND STUDENT COUNSELOR

7.1 Class Advisor

Head of the Department will allot one faculty member to each class as class advisor. The role of the class advisor is to

i. Monitor the attendance of the class,

ii. Class work done by the faculty,

iii. Circulate the notices and circulars pertaining to the class, class time table, test schedule, examination time table, meeting schedule, minutes of the class committee meetings, etc.,

iv. Maintain all important documents of the students for reference/inspection by all committees

iv. Work closely with the student counselors on matters related to students attached to the student counselor and update the students record of the students of the class..

7.2 Student Counselor (Mentor)

HOD will assign a Student Counselor (Mentor) for every 15 students at the time of admission in the first semester who will continue to be the mentor for these students till

they graduate. By guiding and counseling students, teachers can create a greater sense of belongingness amongst our student community. The student counselor will monitor the courses undertaken by the students, check attendance and progress of the students and counsel them periodically. The student counselors should ensure that each student is made aware of the various options for growth and are monitored and guided to become overall performers and help the students to select and work for career choices of their interest. The student counselors shall update and maintain the record of each student attached to them. The student counselors shall also help the class advisors to update the record card of students attached to them. The student counselor may also discuss with the class advisor and HOD and parents about the progress of the students.

8.0 CLASS COMMITTEE

There shall be a class committee for each class in a semester.

8.1 The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class of the first semester (generally common to all branches), the class committee is to be constituted by the first year class coordinator.

8.2 The class committee shall be constituted on the first working day of any semester or earlier.

8.3 At least 4 student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

8.4 A class committee will consists of teachers of the concerned class, student representatives, class advisor, student counselors and a chairperson who is not normally teaching the class,. The function of the class committee include

- Solving problems experienced by students in the class room and in the laboratories.
- Clarifying the regulations of the degree programme and the details of rules
- Informing the student representatives, the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving the problems, if any.
- The committee shall device suitable methods for improving the performance of slow learners identified.

8.5 The Head of the Institution may participate in any class committee of the institution.

8.6 The chairperson is required to prepare the minutes of every meeting, submit the same to Head of the Institution within two days of the meeting and arrange to circulate it among the concerned students and teachers. If there are some points in the minutes requiring action by the institution, the same shall be brought to the notice of the Head of the Institution by the chairperson of the class committee through respective HODs.

8.7 The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held at suitable intervals. During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

9.0 COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or group, shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The 'Course committee' shall meet as often as possible and ensure uniform scheme of evaluation for the test. Wherever it is feasible, the course committee may also prepare a common question paper for the test(s).

10.0 PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

10.1 Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his/her signature and date after due verification. At the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for two years). Any inspection team appointed by the University may inspect the records of attendance and assessment of both current and previous semesters.

10.1.1 The marks allocated for attendance is given in **Table .**

% of Attendance	Marks
<75	Nil
76-80	1
81-85	2
86-90	3
91-95	4
96-100	5

10.2 Theory Courses

There will be two periodical tests, each carrying weightage of 5 marks and one model examination carrying weightage of 10 marks. The distribution of marks for various components for the Internal Assessment is shown below in the table:

S.No	Components for Internal Assessment	Syllabus Coverage for the test / exam	Duration of the test in Minutes.	Marks (max.)
01.	Internal Test – I	2 Units of the Syllabus	90	5
02.	Internal Test – II	Next 2 Units of the Syllabus	90	5
03	Model Test	Full Syllabus	180	10
04	Seminar/Assignment/ Online Test/Quiz	-	-	5
05	Attendance (Refer Clause 10.1.1)	-	-	5
Total				**30**

10.3 Practical Courses:

Every practical exercise / experiment in all practical courses will be evaluated based on the conduct of exercise / experiment and records maintained by the students. There will be at least **one** model practical examination.

The criteria for awarding marks for internal assessment are given in **Table below.**

Items	Marks (Maximum)
Observation	**7.50**
Record	**7.50**
Model Practical	**20**
Attendance { Refer – 10.1.1 }	**5**
Total	**40**

10.4 Project Work

Project work may be assigned to a single student or to a group of students not exceeding 4 per group. For Project work out of 100 marks, the maximum marks for Continuous Assessment is fixed as 40. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of 3 members in the review committee. The project Guide will be one of the members of the Review Committee.

There shall be two assessments (each 100 marks) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The total marks obtained in the two assessment shall be 40 marks

The continuous assessment marks for Project Work will be distributed as given below:

Continuous Assessment 40 Marks			
Review I (20 Marks)		Review II (20 Marks)	
Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide
14	6	14	6

10.5 Seminar / Professional Practices:

The seminar / Professional Practices shall carry 100 marks and shall be evaluated through continuous assessment only. Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar, marks can be equally apportioned. The three member committee appointed by the Head of the Department will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper / report (40%), presentation (40%) and response to the questions asked during presentation (20%).

10.6 Industrial / Practical Training / Internship / Mini Project

The Industrial / Practical Training shall carry 100 marks and shall be evaluated through continuous assessment only. At the end of Industrial / Practical training / internship / Summer Project, the student shall submit a brief report on the training undergone and a certificate from the organization concerned. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Department. Certificates (issued by the Organization) submitted by the student shall be attached to the mark list and sent to the Controller of Examinations by the Head of the Department.

10.7 Term Paper

i. The students shall carry out this course under the guidance / supervision of a faculty. The "Term Paper" course is individual based.

ii. For the Term Paper course out of 100 marks, the maximum marks for Continuous Assessment is fixed as 40. The Head of the Department shall constitute a review committee for this course. There shall be two reviews and each review carries 20 marks. Every student is expected to identify a topic with substantial literature survey and the technological development of the topic and should submit a report by end of the semester and the students should also prepare a paper on the subject matter of the Term Paper and submit the same to some journal for publication or to a conference for presentation.

iii. At the end of the semester a viva-voce examination will be conducted by an external, internal examiners and the guide on the term paper report submitted by the students. The report evaluation and Viva Voce shall carry a max mark of 30 marks and the paper prepared for the publication shall carry a max mark of 30 based on the quality.

10.8 Comprehension

The comprehension course is offered as two different courses, one in the V semester and the other in the VIII semester, each carrying one credit. The comprehension courses are evaluated by Viva-Voce examination on the subjects studied till that semester of assessment.

10.9 Massive Open Online Course (MOOC)

The students are permitted to opt for Massive Open Online Course(s) listed in the UGC website or any other Organisation or Institution either within India or Abroad as Open Elective with 3 credits. The Assessment method if specified any for the respective course in the web site or as standard procedure followed for any theory course as per the regulation shall be followed.

11.0 END SEMESTER EXAMINATIONS:

11.1. Theory Courses

The examinations shall ordinarily be conducted between October and December during the odd semesters and between April and June in the even semesters The End Semester Examination question paper pattern is given below:

Syllabus Coverage	Duration of the Exam in Hours	Question Pattern
Full Syllabus	3	**Part – A, 10x2 = 20** Short answer Type, 10 questions each carrying 2 marks. 2 questions from each unit. **Part – B, 5x6 = 30** Para /Analytical Type, 5 questions, one from each unit EITHER - OR type. **Part – C, 5x10 = 50** Essay/Design/Analytical Type, 5 questions out of 7 covering the full syllabus
		Max mark = 100

However, the question paper pattern for courses in engineering graphics and machine drawing may be designed differently to suit the specific needs of the courses.

11.2. Practical Courses

End Semester examination for practical courses will be conducted jointly by one internal examiner and one external examiner appointed by the Controller of Examinations with the recommendation of the Head of the Dept.

11.3. The maximum marks for each theory shall be 100 comprising of 30 marks for internal assessment and 70 marks for the end semester examinations conducted by the University. The maximum marks for each practical course (including the project Work and Viva Voce Examination in the Eighth Semester) shall be 100 comprising of 40 marks for internal assessment and 60 marks for the end semester examinations conducted by the University.

11.4 PROJECT WORK

The student(s) is expected to submit the project report on or before the last working day of the semester. The University examination for the project work shall consist of evaluation of the final project report submitted by the student or students of the project group by an external examiner followed by a viva-voce examination conducted separately for each student by a committee consisting of an external examiner and an internal examiner. The Controller of Examinations shall appoint Internal and External Examiners from the panel of examiners recommended by the Head of the Department for the End Semester Examinations of the Project Work.

The End Semester Examination marks for the Project Work and for the Viva-Voce Examination will be distributed as given below.

End Semester Examination 60 Marks		
Report Evaluation (20 Marks)	Viva – Voce (40 Marks)	
External Examiner	External Examiner	Internal Examiner
20	20	20

If the project report is not submitted on or before the specified deadline, an extension of time up to a maximum of 30 days may be given for the submission of project work with due approval obtained from the Head of the Department. If the project report is not submitted even beyond the extended time then the student(s) is deemed to have failed in the Project Work. The failed student(s) shall register for the same in the subsequent semester and repeat the project work again.

12.0 SUPPLEMENTRY EXAMINATIONS

After the publication of eighth semester results, supplementary examinations will be conducted to the students who have failed in any of theory courses in any of the semesters

with no arrears in the practical Examinations. Interested students should register for the examinations required by them. Controller of examination will schedule supplementary examinations after the last date of registering for the supplementary examinations.

Pattern of evaluation will be the same as that of the end semester examinations. For non theory examinations supplementary examinations are not applicable.

13.0 MALPRACTICE

If a student indulges in malpractice in any internal test/model examination/end semester examination, he/she shall be liable for punitive action as recommended by the Malpractice committee.

14.0 REQUIREMENTS FOR APPEARING FOR UNIVERSITY EXAMINATIONS

A candidate shall normally be permitted to appear for the semester Examinations of the current semester if he/she has satisfied the semester completion requirements (Vide Clause 6.0) and has registered for examination in all courses of the semester

15.0 PASSING REQUIREMENTS

A candidate who secures not less than 50% of total marks earned in the internal and end semester examination put together in theory course or practical courses or project work shall be declared to have passed the examination in that course.

15.1 If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the subsequent semester when examination is conducted in that course; he/she should continue to register and reappear for the examinations till he / she secures a pass. However the internal assessment marks obtained by the candidate in the first attempt shall be retained and considered valid for all subsequent attempts. In exceptional cases, a candidate may be permitted by the Head of the Institution to redo the courses for improving the internal assessments marks.

16.0. METHODS FOR REDRESSAL OF GRIEVANCES IN EVALUATION

16.1. Students who are not satisfied with the grades awarded can seek redressal by the methods given in the Table below:

Redressal Sought	Methodology
Request for photocopy of the answer script and or request for revaluation	To apply to COE within 7 days of declaration of the result/within 7 days of obtaining the photocopy along with the payment of the prescribed fee.

These are applicable only for theory courses in regular and arrear end semester examinations.

16.2 Challenge of Evaluation

If one is not satisfied with the result, can make an appeal to the CoE for the review of

answer scripts after paying the prescribed fee within 7 days after the declaration of the examination result/revaluation result.

17.0 AWARD OF LETTER GRADES

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate as detailed below:

Range of total marks	Letter Grade	Grade points
90-100	S	10
80-89	A	9
70-79	B	8
60-69	C	7
55-59	D	6
50-54	E	5
0 to 49	U	0
Incomplete	I	0
Withdrawal	W	0

"U" denotes failure in the course.

"I" denotes incomplete as per clause 6.0 and hence prevention from writing End-Semester examination.

"W" denotes withdrawal from the course.

After results are declared, Grade Sheets will be issued to each student which will contain the following details:

The list of courses enrolled during the semester and the grade scored.

The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding grade points to the grades scored in those courses taken for all the courses to the sum of the number of credits of all the courses in the semester.

GPA = Sum of (C*GP)/Sum of C

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. “U”, “I” and “W” grades will be excluded for calculating GPA and CGPA.

18.0 ELIGIBILITY FOR THE AWARD OF THE DEGREE

A student shall be declared to be eligible for the award of the B.Tech Degree provided the student has

18.1 Successfully completed the course requirement and has passed all the prescribed examinations in all the 8 semesters (6 semesters for lateral entry) within a maximum period of 7 years (6 years for lateral entry) reckoned from the commencement of the first semester to which the candidate was admitted.

18.2 No disciplinary action is pending against him/her.

18.3 The award of the degree must be approved by the Board of Management of the University.

19.0 CLASSIFICATION OF THE DEGREE AWARDED

19.1 A candidate who qualifies for the award of the degree (vide clause 18.0) having passed examination in all the courses of all the eight (8) semesters (six (6) semesters in the case of lateral entry) in his/her First Appearance within eight (8) consecutive semesters (six (6) consecutive semesters for lateral entry) and securing a CGPA of not less than 8.0 shall be declared to have passed the examination in **first class with distinction**. For this purpose the withdrawal from examination (vide clause 20.0) will not be construed as an appearance. Further authorized break of study (vide clause 21.3) will not be counted for the purpose of classification.

19.2 A candidate who qualifies for the award of the degree (vide clause 18.0) having passed the examination in all the courses within a maximum period of twelve (12) semesters (ten (10) semesters for lateral entry) and securing a CGPA of not less than 6.50 shall be declared to have passed the examination in **First Class**. For this purpose the authorized break of study (vide clause 21.3) will not be counted for the purpose of classification.

19.3 All other candidates (not covered in clauses 19.1 and 19.2) who qualify for the award of the degree (vide Clause 18.0) within a maximum period of twelve (12) semesters (ten (10) semesters for lateral entry) shall be declared to have passed the examination in **Second Class**.

19.4 All other candidates (not covered in clauses 19.1, 19.2 & 19.3) who qualify for the award of the degree during the extended period as per the clause 4.2 shall be considered as a private candidate and also not be eligible for ranking and they shall be eligible to get only a **pass** certificate.

19.5 A candidate who is absent in semester examination in a course / project work after having registered for the same shall be considered to have appeared in that examination for the purpose of classification.

20.0 PROVISION FOR WITHDRAWAL FROM END-SEMESTER EXAMINATION

20.1A candidate may for valid reasons be granted permission to withdraw from appearing for the examination of only any one semester examination during the entire duration of the degree programme. Also only one application for withdrawal is permitted for that semester examination in which withdrawal is sought.

20.2Withdrawal application shall be valid only if the candidate is otherwise eligible to write examination and if it is made within the prescribed number of days prior to the commencement of the examination in that course or courses and also recommended by the Head of the Department and the Head of the Institution.

20.3 A candidate for valid reasons like sudden illness or accident or unexpected natural calamities not able to be present in the examination hall in time or absent for the examination may seek post permission for the withdrawal from the examination.

20.4 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.

21.0 TEMPORARY BREAK OF STUDY FROM A PROGRAMME

21.1 A candidate is not normally permitted to temporarily break the study. However, if a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the programme in a later semester he / she apply to the Head of the Institution in advance, in any case, not later than the last date for registering for the semester in question, through the Head of the Department stating the reasons thereof.

21.2 The candidates permitted to rejoin the programme after break of study shall be governed by the rules and regulation in force at the time of rejoining.

21.3 The duration specified for passing all the courses for the purpose of classification (vide clause 19.1 and 19.2) shall be increased by the period of such break of study permitted.

21.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5.0 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree (vide clause 18.0).

21.5 If any student is detained for want of required attendance, progress and good conduct, the period spent in that semester shall be considered as permitted 'Break of study' and clause 21.3 is not applicable for this case.

22.0 INDUSTRIAL VISIT

Every student is required to undergo one Industrial visit in every semester starting from the third semester of the Programme arranged by the Head of the Department.

23.0 FAST TRACK PROGRAMME

Fast track programme is introduced as an option for the bright students enabling them to complete the course in a short duration.

23.1 Eligibility

Those students who have secured CGPA of 9 and above at the end of 2nd semester are eligible to opt for the fast track scheme.

23.2 Structure of the Fast Track Scheme

The curriculum is framed in such a way that the eligible students who opt for fast track scheme will be able to complete the degree course in a period of three years. There will be two summer terms conducted one after the 2nd semester and another after the 4th semester during the summer vacations. Each summer term will a have maximum of three theory courses and two laboratory practical courses. However, the total number of credits to be earned for the award of degree will remain the same as that of the concerned regular programme.

24.0 MIGRATION/TRANSFER OF CANDIDATES

24.1 Migration/Transfer of candidates from another University approved by UGC shall be granted.

24.2 All Migrations/Transfers are subject to the approval of the Vice Chancellor

25.0 DISCIPLINE

Every student is required to observe disciplined and decorous behavior both inside and outside the Institute and not to indulge in any activity which will tend to bring down the prestige of the University/Institute. The Dean shall constitute a disciplinary committee consisting of Dean, Head of the departments to which the student concerned belongs, and the Head of another department to enquire into acts of indiscipline and notify the University about the disciplinary action recommended for approval.

26.0 REVISION OF REGULATIONS AND CURRICULUM

The University may from time to time revise, amend or change the Regulations, Curricula, Syllabi and scheme of examinations through the Academic Council with the approval of Board of Management.

CURRICULUM & SYLLABUS (R2015)
CHOICE BASED CREDIT SYSTEM
(Applicable to the batches admitted from July 2015)

B.TECH – MECHATRONICS
FULL TIME
I – VIII SEMESTERS

SEMESTER I						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN101	HS	English-I	3	1	0	3
BMA101	BS	Mathematics –I	3	1	0	3
BPH 101	BS	Engineering Physics – I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BSS101	HS	Personality Development	1	1	0	2
BBT 102	BS	Biology for Engineers	2	0	0	2
BCE101	ES	Basic Civil Engineering	2	0	0	2
BME101	ES	Engineering Graphics-E	2	3	0	4
PRACTICAL						
BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
BPC1L1/2L1*	BS	Physics and Chemistry Laboratory	0	0	3	0
BSS1L4/ 1L5/IL6	HS	NCC/NSS/NSO (to be conducted during week ends)	0	1	2	1
*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						
Total No. of Contact Hours: 37 Total No. of Credits: 27						

SEMESTER II						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN 201	HS	English-II	3	1	0	3
BMA201	BS	Mathematics- II	3	1	0	3
BPH 201	BS	Engineering Physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
BFR201#	HS	Foreign/Indian Language	3	0	0	3
BME202	ES	Engineering Mechanics	3	1	0	3
BEE201	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL						
BCS2L2	ES	Computer Practices Lab	0	0	3	1
BEE2L1	ES	Basic Electrical and Electronics Engineering Practices	0	0	3	1
BPC1L1/2L1*	BS	Physics and Chemistry Laboratory	0	0	3/3	1
BSS2L7	HS	Yoga	0	1	2	1
# Any one of the following courses: BFR201 – French, BGM201 – German, BJP201- Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil						
*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						
Total No. of Contact Hours: 35			**Total No. of Credits: 24**			

SEMESTER III						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMA301	BS	Mathematics – III	3	2	0	4
BME301	PC	Kinematics of Machines	4	0	0	4
BMT303	PC	Electronic Devices and Electronic Circuits	4	0	0	4
BMT304	PC	Mechanics of Solids and Fundamentals of Fluids	4	0	0	4
BMT301	PC	Digital Electronics	3	0	0	3
BMT302	PC	Electrical Machines & Drives	3	0	0	3
PRACTICAL						
BMT3L1	PC	Electronic Devices and Electronic Circuits - Lab	0	0	3	2
BMT3L2	PC	Electrical Machines & Drives Lab	0	0	3	2
BMT3L3	PC	Computer Aided Machine Drawing	0	0	3	2
Total No. of Contact Hours: 32 Total No. of Credits: 28						

SEMESTER IV						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMA402	BS	Numerical Methods	3	2	0	4
BME401	PC	Dynamics of Machines	4	0	0	4
BMT401	PC	Manufacturing Technology	3	0	0	3
BEE404	PC	Power Electronics	3	0	0	3
BEI402	PC	Control Systems	4	0	0	4
BCE406	BS	Environmental Studies	3	0	0	3
PRACTICAL						
BMT4L1	PC	Manufacturing Technology Lab	0	0	3	2
BMT4L2	PC	Machine Dynamics Lab	0	0	3	2
BEE4L2	PC	Power Electronics Lab	0	0	3	2
BMT4S1	PR	Technical Seminar	0	0	2	1
Total No. of Contact Hours: 33 Total No. of Credits: 28						

SEMESTER V						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMT501	PC	Thermodynamics Principles and Applications	4	0	0	4
BEC501	PC	Microprocessors & its Applications	3	0	0	3
BMT503	PC	Instrumentation & Control	3	0	0	3
BMT502	PC	CNC Technology	3	0	0	3
BMT504	PC	Dimensional Metrology	3	0	0	3
BMT5E1	CE	Core Elective – I	3	0	0	3
PRACTICAL						
BEC5L2	PC	Microprocessors Lab	0	0	3	2
BMT5L1	PC	Instrumentation and Control Lab	0	0	3	2
BMT5L2	PC	CNC Lab	0	0	3	2
BMT5C1	PR	Comprehension - I	0	0	0	1
Total No. of Contact Hours: 28		**Total No. of Credits: 26**				

SEMESTER VI						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMT601	PC	Sensors & Signal Processing	3	0	0	3
BMT602	PC	Applied Hydraulics & Pneumatics	3	0	0	3
BMT604	PC	Micro Controller & PLC	4	0	0	4
BSS601	HS	Value Education and Professional Ethics	3	0	0	3
BMT6E2	CE	Core Elective – II	3	0	0	3
BMT6E3	NE	Non Major Elective – I	3	0	0	3
PRACTICAL						
BMT6L1	PC	Sensors & Signal Processing Lab	0	0	3	2
BEC6L6	PC	Micro Controller & PLC Lab	0	0	3	2
BMT6L2	PC	Hydraulics & Pneumatics Lab	0	0	3	2
BMT6V1	PR	Inplant Training(End of V sem- 15 days)	0	0	0	1
Total No. of Contact Hours: 28		**Total No. of Credits: 26**				

SEMESTER VII						
Code No.	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMT702	PC	Simulation & Modeling	3	0	0	3
BMT701	PC	Robotics & Machine Vision System	3	0	0	3
BAM705	PC	Automotive Electronics	3	0	0	3
BMT7E4	CE	Core Elective – III	3	0	0	3
BMT7E5	NE	Non Major Elective - II	3	0	0	3
BMT7E6	OE	Open Elective – I	3	0	0	3
PRACTICAL						
BME7L3	PC	CAD/CAM Lab	0	0	3	2
BMT7L3	PC	Robotics Lab	0	0	3	2
BMT7P1	PR	Term Paper	0	0	4	2
Total No. of Contact Hours: 27 Total No. of Credits: 24						

SEMESTER VIII						
Code No.	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMT8E7	NE	Non Major Elective – III	3	0	0	3
BMT8E8	OE	Open Elective – II	3	0	0	3
PRACTICAL						
BMT8C1	PR	Comprehension– II	0	0	0	1
BMT8P1	PR	Project Work & Viva Voce	0	0	18	9
Total No. of Contact Hours:24 Total No. of Credits:16						

OVERALL CREDITS: 199

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	-	-	3	-	-	16	08.04
2	Maths &Basic Sciences (BS)	11	10	4	7	-	-	-	-	32	16.58
3	Engineering Sciences (ES)	10	7	-	-	-	-	-	-	17	8.5
4	Professional Core (PC)	-	-	24	20	22	16	13	-	95	47.73
5	Core Electives (CE)	-	-	-	-	3	3	3	-	9	4.54
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	4.54
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3.03
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	1	1	1	2	10	15	7.57
	Total Credit	27	24	28	28	26	26	24	16	199	100%
	Total Contact Hour	37	35	32	33	28	28	26	24	242 Hrs	

LIST OF ELECTIVES

Code No.	Course Title	L	T	P	C
CORE ELECTIVE (CE)-I					
BMT001	Integrated Circuits	3	0	0	3
BMT002	Virtual Instrumentation	3	0	0	3
BME001	Industrial Engineering	3	0	0	3
CORE ELECTIVE (CE) - II					
BMT003	Computer Integrated Manufacturing	3	0	0	3
BMT004	Neural Network & Fuzzy Logic	3	0	0	3
BMT005	Embedded System and Design	3	0	0	3
CORE ELECTIVE(CE) -III					
BMT007	Micro Electronics and Nano Electronics	3	0	0	3
BMT008	MEMS and Nano Technology	3	0	0	3
BMT009	Rapid Prototyping	3	0	0	3
NON MAJOR ELECTIVE(NE)-I					
BMT010	Design of Mechatronics Systems	3	0	0	3
BMT011	Product Design and Costing	3	0	0	3
BMT012	Artificial Intelligence	3	0	0	3
NON MAJOR ELECTIVE(NE)-II					
BMT013	Medical Mechatronics	3	0	0	3
BMT014	Consumer Electronics	3	0	0	3
BMT015	Digital Signal Processing	3	0	0	3
NON MAJOR ELECTIVE(NE)-III					
BMT016	Digital Image Processing	3	0	0	3
BMT017	Networking of Computers	3	0	0	3
BMT018	Computational Fluid Dynamics	3	0	0	3
OPEN ELECTIVE(OE)- I					
BBA001	Principles of Management And Organizational Behavior	3	0	0	3
	Statistical Quality Control	3	0	0	3
BBA002	Entrepreneurship Development	3	0	0	3
BBA009	Intellectual Property Rights	3	0	0	3
BSS001	NSS Paper I	2	0	2	3
OPEN ELECTIVE(OE)- II					
BBA003	Marketing Management	3	0	0	3
BBA008	Total Quality Management	3	0	0	3
BBA006	Indian Constitution and Society	3	0	0	3
BBA007	Engineering Economics and Cost Analysis	3	0	0	3
BSS002	NSS Paper I	2	0	2	3
BMO001	Massive Open Online Course	3	0	0	3

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	e to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT ISTRUCTURES 12

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II TRANSCODING 12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III REPORTING 12

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION 12

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V METHODOLOGY 12

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectively in their respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant real life problems in engineering.
CO6	Formulate a mathematical model for three dimensional objects and solve

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			M		H							
	CO3		H				M						

	CO4								L				
	CO5							H			L		
	CO6											L	
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√									
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT-1 MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes-Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7thEdition, Pearson Education, 2007.

3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	**ENGINEERING PHYSICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:
To enhance the fundamental knowledge in Physics and its applications relevant to various stre of Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	**ENGINEERING CHEMISTRY - I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable and industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventional energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf and applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/Seminar /Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working –uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BCS101	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems
CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions.Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Arrays - Handling of Character Strings - Pointers – Structures-Union -Functions – Recursion-Call by value and Call by reference.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BSS101	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the socie

COURSE OUTCOMES (COs)

CO1	Individual or in-group class presentations pertaining to the applications of concepts, theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.

CO5	Design and complete a research project that can take the form of a developmental interview, an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 6

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 6

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 6

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 6

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BBT102	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic Science				
	Course Designed by – Department of Industrial Bio Technology				

OBJECTIVES

Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system**.**

COURSE OUTCOMES (COs)

CO1	Graduates within the first five years will be able to grasp and apply biological engineering principles, procedures needed to solve real-world problems.
CO2	To understand the fundamentals of living things, their classification, cell structure and biochemical constituents
CO3	To apply the concept of plant, animal and microbial systems and growth in real life situations
CO4	To comprehend genetics and the immune system
CO5	To know the cause, symptoms, diagnosis and treatment of common diseases
CO6	To give a basic knowledge of the applications of biological systems in relevant industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M					
	CO2		H							H			
	CO3			H							M		
	CO4										H		
	CO5												

	CO6						H						M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)				
			√										
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO LIFE 6

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic andeukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNIT II BIODIVERSITY 6

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes.

UNIT III GENETICS AND IMMUNE SYSTEM 6

Evolution: theories of evolution-**Mendel's** cell division–mitosis and meiosis-evidence of e **laws of inheritance**-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response.

UNIT IV HUMAN DISEASES 6

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

TEXT BOOKS:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCE BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr,

Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

BCE 101	BASIC CIVIL ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES: Understand the basic concepts of civil engineering.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge in Design, concept preparation
CO2	Loading calculation
CO3	Structural component design
CO4	Drawing and chart preparation
CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				
	CO4									L			
	CO5										H	L	
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system.– Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, "Basics of Civil Engineering", Ayyappa Publications, Chennai, 2012.
2. SeetharamanS., "Basic Civil Engineering", Anuradha Agencies, (1st ed. 2005).
3. Dr.M.SPalanisamy, "Basic Civil Engineering" (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, "Engineering Materials", Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, "Building Materials", 2005
3. Ramesh Babu"A Textbook on Basic Civil Engineering" (1998). Anuradha Agencies, Kumbakonam.
4. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).

BME 101	**ENGINEERING GRAPHICS- E**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	2	3	0	4
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES:To understand techniques of drawings in various fields of engineering

COURSE OUTCOMES (COs)

CO1	To know about different types of lines & use of different types of pencils in an Engineering Drawing
CO2	To know how to represents letters & numbers in drawing sheet
CO3	To know about different types of projection
CO4	To know projection of points ,straight lines, solids etc.
CO5	To know development of different types of surfaces.
CO6	To know about isometric projection.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H											H
	CO2	M	H										M

	CO3			L									M
	CO4						L		H	H			L
	CO5			L						H			L
	CO6			L							H		L
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
					√								
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I BASIC CURVES, PROJECTION OF POINTS AND STRAIGHT LINES 6+6

Conics-construction of ellipse, parabola and hyperbola by eccentricity method-construction of cycloids- construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards-Orthographic projection principles- Principal planes-First angle projection- Projection of points. Projection of straight lines (only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces.

UNIT II PROJECTIONS OF PLANES AND SOLIDS 6+6

Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone, tetrahedron and truncated solids when the axis is inclined to one of the principal planes/ both principal planes by rotating object method and auxiliary plane method.

UNIT III ORTHOGRAPHIC PROJECTIONS, ISOMETRIC PROJECTIONS & FREEHANDSKETCHING 6+6

Orthographic projection of Simple parts from 3D diagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids- Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems Free hand sketching of orthographic & Isometric projection

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+6

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids- Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

.

UNIT V PERSPECTIVE PROJECTION, BUILDING DRAWING AND COMPUTER AIDED DRAFTING 6+6

Perspective projection of simple solids-Prisms, Pyramids and cylinders by visual ray method.Introduction- components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings.Introduction to drafting packages and basic commands used in AUTO CAD.Demonstration of drafting packages.

TEXT BOOKS:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. K.V.Natarajan "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.

REFERENCES:

1. K.R.Gopalakrishna, "Engineering drawing",(Vol-I & II combined) Subhas stores, Bangalore,2007.
2. K.Venugopal and V. Prabhu Raja, "Engineering Graphics", New Age International Private limited,2008.
3. Luzzader, Warren.J., and Duff, John.M.,, "Fundamentals of Engineering Drawing with an introduction to Interactive computer graphics for design and production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi,2005.

Special points applicable to University Examinations on Engineering Graphics

1) There will be five questions, each of either or type covering all units of the syllabus.
2) All questions will carry equal marks of 20 each making a total of 100.

BCM1L1	**BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques
CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
					√								
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspects.

PlumbingWorks:

a) Studyofpipelinejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbowsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:Basicpipeconnection ofPVCpipes&G.I.Pipes–Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise:Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:

b) Modelmaking–Trays,funnels, etc.
c) Differenttypeofjoints
d) Preparationofair-conditioningducts
e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump
b) Assembling,dismantlingand Studyofairconditioner
c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulleyetc

Fitting:

a) FittingExercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.
b) Gaswelding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices Lab Manual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice", Tata McGraw–Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", SreeSai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Scitech Publication, (1999).

	PHYSICS AND CHEMISTRY LABORATORY	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
BPC 1L1/2L1	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS 1L5 / 2L5 **NSS PRACTICAL** **L T P C**
0 1 2 1

OBJECTIVES

1. Understand the community in which they work and their relation
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop capacity to meet emergencies and natural disasters
4. Practice national integration and social harmony and
5. Utilize their knowledge in finding practical solutions to individual and community problems.

1. Regular Activities Programme

1) Traffic regulation
2) Working with Police Commissioner's Office
3) Working with Corporation of Chennai
4) Working with Health Department
5) Blind assistance
6) Garments collection
7) Non-formal education
8) Environmental Education, Awareness and Training (EEAT)
9) Blood donation

2.Special camp Programme

A) Legal awareness
B) Health awareness
C) First-aid
D) Career guidance
E) Leadership training - cum - Cultural Programme
F) Globalization and its Economic Social Political and Cultural impacts.

REFERENCE BOOKS:

1. National Service Scheme Manual, Government of India.
2. Training Programme on National Programme scheme, TISS.
3. Orientation Courses for N.S.S. Programme officers, TISS.
4. Case material as Training Aid for field workers, Gurmeet Hans.
5. Social service opportunities in Hospitals, Kapil K.Krishan,TISS.
6. Social Problems in India, Ram Ahuja.

BEN 201	**ENGLISH II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				
OBJECTIVES					
Students will be able to actively participate in group discussions. Students will have Telephonic Skills, Giving Directions and Information Transfer					
COURSE OUTCOMES (COs)					
CO1	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)				
CO2	To make students comprehend the habit of intelligent Reading as well as Computer- based competitive exams glob				

CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO5	To achieve a reasonably good level of competency in group discussions
CO6	To achieve a reasonably good level of competency in public speaking

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ORIENTATION12

Numerical adjectives - Meanings in context - Same words used as different parts of speech - Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things-etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints pvt ltd.2013.
2. Meenakshi Raman and SangeethaSharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and so special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat flow, s mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regress equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		L									
	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	
	CO4					M						M	
	CO5										M	M	
	CO6										M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – **Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration– **Green's theorem in a plane , Gauss divergence theorem and** S**toke's theorem (**without proofs) – simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – construction of analytic functions – conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – **Statement and application of Cauchy's integral theorem and Cauchy's integral formula** –Taylor and Laurent expansions – Singular points – Residues – Residue theorem –Application of Residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode – Moments –Skewness and Kurtosis – Correlation – Rank Correlation – Regression –Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rd Edition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	ENGINEERING PHYSICS -II	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				
	Course Designed by – Department of Physics				

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory –

Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				

	Course Designed by – Department of Chemistry

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts and further industrial applications of surface chemistry
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys
CO3	To make the students to be conversant with Analytical techniques of chemistry and their importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent , adsorbate and sorption – (definition only) Differences between adsorption and absorption Adsorption of gases on solids – factors affecting adsorption of gases on solids – Adsorption isotherms –Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys –nichrome and stainless steel – 18/8 stainless steel -

heat treatment of steel – annealing – hardening – tempering normalizing – carburizing - nit riding . Non- ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV-visible spectroscopy –– principle – instrumentation (block diagram only) – Beer-**Lambert's law**- – estimation of iron by colorimetry– Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS 9

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS 9

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness) Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand &Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

	FRENCH	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3

BFR 201	Prerequisite – +2 Level English
	Course Designed by – Department of English

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that cultures define themselves through languages.

COURSE OUTCOMES (COs)

CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respond in simple everyday contexts.
CO4	Synchronies I includes documents which initiate the learners to another world, another culture and which acclimatize them to the authentic use of the French language through the exploitation of written and iconographic documents. The Indian context has been used.
CO5	Grammatical and lexical notions as well as activities required for communication are learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs ‘to be’, ‘to call oneself’, subject pronouns, interrogation

UNIT II GRAMMAR 8

At the University: Savoir-faire: enquiring after one's welfare, taking leave, expressing appreciation -Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular 'er' verbs, 'to have', 'to learn', negation, irregular verbs

UNIT III CONVERSATION 8

At the café: Savoir –faire: speaking about one's likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING 7

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS 7

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS 7

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 201	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to read, write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT I PRONOUNCIATION 9

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT II SELF INTRODUCTION 9

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self introduction

UNIT III TRAINING 9

Addresses, Occupations, Studies - Grammar - **'to be', the definite/indefinite** articles, individual Training

UNIT IV ORAL 9

Leisure Time, Sports, Hobbies - Grammar **–** position of a verb in a main clause , oral practice

UNIT V NARRATION 9

At a Restaurant, Food and Drink - Grammar **–** the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

	JAPANESE	L	T	P	C
BJP 201	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CULTURAL HERITAGE 9

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar– usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR 201	**KOREAN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage
To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PLANNING 9

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT II MODIFIERS 9

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT III PLACING ORDERS 9

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IV DESCRIPTIONS 9

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT V GRAMMAR 9

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 201	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage

To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.

CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT 1 RISE OF DIALECTS **9**

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT II VARIETIES **9**

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS **9**

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS **9**

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V GRAMMAR **9**

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729-071-7,978-1-55729-071-7.

3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.

4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.

5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 2013

BME 202	**ENGINEERING MECHANICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – Engineering Mathematics I , II, Engg. Physics				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES: To understand the concept of basic engineering mechanism

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts of engineering mechanics
CO2	Students will understand the vectorial representation of forces and moments
CO3	Students will gain knowledge regarding center of gravity and moment of inertia and apply them for practical problems.
CO4	Students will gain knowledge regarding various types of forces and reactions and tom draw free body diagram to quicker solutions for complicated problems.
CO5	Student will gain knowledge in solving problems involving work and energy
CO6	Student will gain knowledge on friction on equilibrium and its application.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I BASICS AND STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics – **Lame's theorem, Parallelogram and triangular Law** of forces – Vectors –Vectorial representation of forces and moments – Vector operations on forces - Coplanar Forces – Resolution and Composition of forces – Resultant of several concurrent forces - Equilibrium of a forces – Forces in space - Equilibrium

of particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples– Scalar components of a moment – **Varignon's theorem** - Equilibrium of Rigid bodies in two dimensions -Equilibrium of Rigid bodies in three dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of areas – First moment of area and the Centroid of standard sections – T section, I section, Composite figures, Hollow section – second moments of plane area – Rectangle, triangle, circle - T section, I section, Hollow section – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Basic concept of Mass moment of inertia.

UNIT IV FRICTION12

Frictional force – Laws of Coloumb friction – Cone of friction – Angle of repose – Simple contact friction – Sliding of blocks – Wedge friction - Ladder friction – Screw Jack – Belt friction - Rolling resistance.

UNIT V DYNAMICS OF PARTICLES12

Displacements, Velocity and acceleration, their relationship – Relative motion – Relative acceleration – Curvilinear motion of particles – **Newton's law** – work energy equation – impulse and Momentum – Impact of
elastic bodies.

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers: Vol. 1 Statics and vol. 2 Dynamics**"**, McGraw-Hill International Edition, 2013.
2. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2011.

REFERENCES :

1. Kumar, K. L Kumar, V., Engineering Mechanics, Tata McGraw – Hill, New Delhi, 2010
2. Palanichamy, M.S., Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw - Hill, 2013.
3. Timoshenko, and Young, Engineering Mechanics, Tata McGraw-Hill, New Delhi, 2013.
4. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition – Pearson Education Asia Pvt., Ltd., 2006.

BEE 201	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To understand the laws of electrical engineering.													
COURSE OUTCOMES (COs)													
CO1	Students will gain knowledge regarding the various laws and principles associated with electrical systems.												
CO2	Students will gain knowledge regarding electrical machines and apply them for practical problems.												
CO3	Students will gain knowledge regarding various types semiconductors.												
CO4	Student will gain knowledge digital electronics.												
CO5	Student will gain knowledge on electronic systems.												
CO6	Students will acquire knowledge in using the concepts in the field of electrical er projects and research.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem - Problems.

UNIT II ELECTRICAL MACHINES6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method **–** and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES6

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and its Applications – HWR, FWR –Zener Diode – BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS6

Number system – Logic Gates – Boolean Algebra– De-**Morgan's Theorem –** Half Adder & Full Adder – Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. "Theory and Problems of Electric Circuits" Schaum's Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. "Engineering Circuit Analysis", McGraw Hill Internatinal Editions, 1993.
3. D. P. Kothari and I. J. Nagrath" Electric Machines"Tata McGraw-Hill Education, 2004
4. Millman and Halkias, "Integrated Electronics", Tata McGraw Hill Edition, 2004.

BCS 2L2	**COMPUTER PRACTICE LABORATORY**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									0	0	3	1
	Prerequisite – Fundamentals of Computer												
	Course Designed by – Department of Computer Science &Engineering												
OBJECTIVES: To impart basic computer knowledge													
COURSE OUTCOMES (COs)													
CO1	Demonstrate major algorithms and data												
CO2	Implementation of array operations												
CO3	Implementation of binary tree.												
CO4	Implementation of linked list												
CO5	Students will able to do analyse data using spread sheet												
CO6	Student will able to understand the basics of C programming.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

A) WORD PROCESSING 6

Document creation, Text manipulation with Scientific Notations.Table creation, Table formatting and Conversion.Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET 9

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* 15

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING 15

-Classes and Objects

-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

BEE2L1	**BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments

COURSE OUTCOMES (COs)

CO1	Students will able to handle basic electrical equipments.
CO2	Students will able to do staircase wiring.
CO3	Students will able to understand domestic wiring procedures practically.
CO4	Student will able to assemble electronic systems.
CO5	Students will understand all the fundamental concepts involving electrical engineering
CO6	Students will understand all the fundamental concepts involving electronics engineering

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
						√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

	PHYSICS AND CHEMISTRY LABORATORY	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
BPC 1L1/2L1	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				
OBJECTIVES: To impart knowledge to the students in practical physics and chemistry					
COURSE OUTCOMES (COs)					
CO1	Students will understand the concept of hall effect				
CO2	Students will understand the concept of semiconductors. .				
CO3	Student will understand the working of spectrometer.				

CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)

8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS1L7/BSS2L7 YOGA FOREMPOWERMENT

L	T	P	C
0	1	2	1

OBJECTIVE:
Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life

UNIT I PHYSICAL HEALTH 6

Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.

Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.

Yogasanas 1: Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.

Pranayama: Naddi suddi - Clearance Practice - Benefits.

Simplified Physical Exercise - Kayakalpa Practices - Meditation Practices.

UNIT II LIFE FORCE 6

Reasons for Diseases: Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)

Philosophy of Kaya kalpa: Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.

Maintaining youthfulness: Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion.

Kayakalpa practice: Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III MENTAL HEALTH 6

Mental Frequencies: Beta, Apha, Theta and Delta wave - Agna Meditation explanation-benefits.

Shanti meditation: Shanthi Meditation explanation-benefits

Thuriya Meditation: Thuriya Meditation explanation-benefits

Benefits of Blessing: Self blessing(Auto suggestion) - Family blessing - Blessing the others - World blessing - Divineprotection

UNIT IV VALUES 6

Human Values: Self control - Self confidence - Honesty Contentment - Humility - Modesty Tolerance – Adjustment - Sacrifice - Forgiveness

Purity(Body,Dress,Environment) - Physicalpurity-Mentalpurity - Spiritual purity

Social Values :
Non violence - Service Patriotism - Equality
Respectforparentsandelders - careandprotection - Respectforteacher Punctuality - TimeManagement

UNIT V MORALITY (virtues) 6
Importance of Introspection: I - Mine (Ego, Possessiveness)
SixEvilTemperaments-Greed-Anger - Miserliness-Immoralsexualpassion - InferiorityandsuperiorityComplex - Vengeance
Maneuvering of Six Temperaments: Contentment - Tolerance - Charity - Chastity – Equality - Pardon (Forgiveness)
FiveessentialQualitiesacquiredthroughMeditation:Perspicacity – Magnanimity – Receptivity - Adaptability - Creativity(ImprovedMemoryPower)

Total periods: 30

REFERENCE BOOKS:

1. Yoga for modern age - ThathuvagnaniVethathiri Maharishi
2. Simplified Physical Exercises - ThathuvagnaniVethathiri Maharishi
3. Kayakalpam - Thathuvagnani VethathiriMaharishi
4. Thirukkural -Rev.Dr.G.U.pope
5. Mind-ThathuvagnaniVethathiriMaharishi
6. SoundHealththroughyoga-Dr.Chandrasekaran
7. Light on yoga -BKS.lyenger
8. *உணவுமுறை – தத்துவஞானிவேதாத்திரிமகரிஷி*

BMA301	**MATHEMATICS – III**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	2	0	4
	Prerequisite – Engineering Mathematics-I, Engineering Mathematics -II,				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To understands the concepts of Fourier series analysis, Fourier transform techniques and Z transform techniques

COURSE OUTCOMES (COs)

CO1	To learn the problem solving methods in linear differential equations
CO2	To learn Dirichlet's condition and operations using Fourier series
CO3	To have a clear understanding about 2nd order equations and wave equations
CO4	Properties of Laplace transform and problem solving using it
CO5	Properties of Fourier transform and problem solving using it
CO6	To understand the concepts of various transform and partial differential equation technique

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H	H										
	CO2	H	H			M							
	CO3	H	H			M							
	CO4	H	H										
	CO5	H	H										
	CO6	H	H			L	L						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+6

Formation-solutions of standard types of first order equations-LaGrange's equation-linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9+6

Dirichlet's condition-General Fourier series-half range sine and cosine series-Parseval's identity.Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9+6

Classification of second order linear partial differential equations-Solutions of one- Dimensional wave equations, one-dimensional heat equations.

UNIT IV LAPLACE TRANSFORMS 9+6

Transforms of simple functions-basic operational properties-transforms of derivatives and integrals-Initial and Final value theorems-Inverse transforms-Convolution theorem. Periodic functions. Applications of Laplace Transforms for solving linear ordinary differential equations up to second order with constant coefficients and integral equations.

UNIT V FOURIER TRANSFORMS 9+6

Statement of Fourier integral theory-Fourier transforms pairs-Fourier Sine Cosine transforms-Properties-Transforms of simple functions-Convolution theory-Parseval's identity.

TEXTBOOKS:

1. Kreyszig, E."Advanced Engineering Mathematics"8th Edition, John Wiley and Sons, (Asia) Pvt., Ltd, Singapore, 2006.
2. Grewal, B.S.,"Higher Engineering Mathematics" (35thEdition), Khanna Publishers, Delhi2000.

REFERENCE:

1. Kandasamy, P., Thilakavathy, K., and Gunavathy, Kk. "Engineering Mathematics", Volumes 1 and 3(4th Edition) S Chand and Co., New.
2. Narayanan, S.ManicavachangamPillay, T.K.Ramanaiah, G."Advanced mathematics for

Engineering Students", Volume2 and 3(2nd Edition), S.Viswanathan (printers & publishers Pte, Ltd.,) 1992.
3. Venkataraman, M.K"Engineering Mathematics"Volumes3-A&B, 13th Edition National Publishing Company, Chennai, 1998.
4. Shanmugam,T.N.:http:.www.annauniv.edu/shan/trans.html.

BME301	**KINEMATICS OF MACHINES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I, Basic Mechanics				
	Course Designed by – Dept of Mechanical				

OBJECTIVES

To understand the various concepts in kinematics of various machines and mechanisms.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to apply fundamentals of mechanism for the design of new mechanisms and analyze them for optimum design
CO2	Will know the impact of numerical methods in engineering analysis
CO3	Better understanding on the theoretical background of mechanisms
CO4	Will get the confidence in using mechanisms
CO5	Capability of solving engineering problems will increased
CO6	To understand the concepts of kinematics of various mechanism

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		W	M							
	CO2	H	H		W	M							
	CO3	H	H		W	M							
	CO4	H	H		W	M							
	CO5	H	H		W	M							
	CO6	H	H		W	M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION TO MECHANISMS 12

Introduction-Science of mechanisms-Terms and definitions-Planar, Spherical and spatial mechanisms, Mobility-Classification of mechanisms-Indexing mechanisms, reciprocating mechanism etc. Straight line generators- kinematic inversion- Slider crank chain inversions- Four bar chain inversions- Grashof's law.Determination of velocities and acceleration in mechanisms-Relative motion method (Graphical) for Mechanisms having turning, sliding and rolling pair.

UNIT II SYNTHESIS OF MECHANISMS 16

Classification of kinematics- Synthesis problems- Chebyshev's spacing, Two point synthesis-Freudenstein method- Four bar mechanism and slider crank mechanism.

Types of cams and followers- Follower motions- Uniform, parabolic, SHM, Cycloidal and polynomial-Synthesis of cam profiles for different followers. Cams with specified contours

UNIT III FRICTION 10

Friction-Types-Application-Inclined plane, Screw jack, Clutch, Brakes Bearings, Journal bearing, Flat pivot bearing, multi collar bearings Belt drives.

UNIT IV THEORY OF GEARING 12

Classification of gears, Law of gearing, nomenclature-Forms of teeth, Cycloidal teeth, Involute teeth-Length of path of contact-Length of arc of contact-Contact ratio-Interference and undercutting- Minimum number of teeth to avoid interference- Internal gears- Extended center distance system- Long and short addendum system- Gear trains-Types-Epicyclical gear trains-Automobile differential unit.

UNIT V CONTROL MECHANISMS 10

Governors- Gravity controlled governors-Spring control governors, Hartnell governor, and Hartung governor-Governor characteristics- Governor Effort and power.Gyroscopes-Gyroscopic forces and couple- Forces on bearing due to gyroscopic action- Gyroscopic effects on the movement of aero plans and ships, stability of two wheel drive and four wheel drive, Gyroscopic effects in grinding machines.

TEXTBOOKS:

1. S.S.Rattan-Theory of Machines- Tata McGraw Hill, 3rd Edition, 2009.
2. Bansal- Theory of Machines, 2006.

REFERENCE:

1. Shigley.J.E-Theory of Machines and Mechanisms, 2nd Edition- McGraw Hill Inc,1995
2. V.P.Singh-Theory of Machines ,2001
3. Rao J.S. & Dukkipatti R.V.Mechanisms and Machine Theory, 2nd Edition-Wiley Estern Ltd-1992.

BMT303	**ELECTRONIC DEVICES AND ELECTRONIC CIRCUITS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Mathematics-I, Basic Electronics Engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the basics concepts of various methods of Electronics circuits analysis and various types of electronics devices.

COURSE OUTCOMES (COs)

CO1	Able to get the knowledge about the construction and working of RC, RL and RLC circuits.
CO2	Able to get the knowledge about the semiconductor diodes and special diodes.
CO3	Able to get the basic concepts of Oscillators and Multi-vibrators
CO4	To understand the working principle of Rectifiers.
CO5	To study about the design of various power supply circuits.
CO6	To understand the concepts of various types of electronics devices working and its applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	W	M	H							
	CO2	H	H		M	H							
	CO3	H	M		M	H							
	CO4	H	M	W	M	H							
	CO5	H	H		M	H							
	CO6	H	H	W	W	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CIRCUIT ANALYSIS TECHNIQUES 12

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS 12

Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs –frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III SEMICONDUCTOR DIODES AND SPECIAL DEVICES 12

SEMICONDUCTOR DIODES: Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

SPECIAL DIODES : Tunnel diodes – PIN diode, varactor diode — UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

UNIT IV OSCILLATORS AND MULTIVIBRATORS 12

Oscillators: Classification of oscillators – Barkhausen criterion operation and analysis of RC phase shift, Wien's bridge, Hartely, colpitts oscillators.

Multivibrators: Astable, monostable and bistable – Analysis of performance parameters of multivibrators using 68ehavio Trigger – Blocking oscillators.

UNIT V RECTIFIERS AND POWER SUPPLIES 12

Single –phase, half-wave and full-wave rectifiers – Bridge rectifiers – Ripple factor, rectification efficiency-Transformer Utilisation Factor and regulation – Performance characteristics of rectifiers with filters – Regulated power supply – Series and shunt type voltage regulators – Switched mode power supplies.

TEXTBOOKS:

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum Series,TataMcGraw Hill, (2001)
2. S. Salivahanan, N. Suresh Kumar and A. Vallavanraj, "Electronic Devices andCircuits",Tata McGraw Hill, 2nd Edition, (2008).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5thEdition, (2008).

REFERENCE:

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering CircuitAnalysis", Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGrawHill, 2nd Edition, 2008.

BMT304	**MECHANICS OF SOLIDS AND FUNDAMENTALS OF FLUIDS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Engg Mathematics-I, Engg Mathematics-III, Basic Mechanical engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the basics concepts of various mechanism in solids and fundamentals about fluids

COURSE OUTCOMES (COs)	
CO1	textbook and auxiliary handout reading assignments
CO2	To understand the different types of beams and bending moment and shear force
CO3	To learn the power transmission and strain energy and stiffness and buckling
CO4	To learn the flow characteristic fluid continuity, Euler's equation

CO5	To learn the principles of dimensional analysis												
CO6	To learn the various applications of solids and fluids mechanism												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M		L	H	L						
	CO2	H	M		L	H	L						
	CO3	H	M		L	H	L						
	CO4	H	M		L	H	L						
	CO5	H	M		L	H	L						
	CO6	H	M		L	H	L						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 12

Concept of stress-strain- Hooke's law- Tension- Compression and shear- Stress strain diagram, poisson's relation-Volumetric strain- Elastic constants and their relation- Stress in simple and composite bars subjected to axial loading and temperature- State of stress at a point-Principle plane- Principle stress-Normal and longitudinal stresses on a given plane-Mohr's circle of stresses.

UNIT II TRANSVERSE LOADING ON BEAMS, SHEAR FORCE AND BENDING MOMENT 12

Types of Beams- Transverse loading on beams shear force and Bending moment in beams – Cantilever- Simply supported, overhanging beam subjected to concentrated load and UDL – Maximum bending moment and point of contra flexure-Theory of simple bending and assumption – Derivation of formulae M/I = F/Y = E/R and its applications to engineering – Leaf spring.

UNIT III TORSION, SPRINGS AND COLUMNS 12

Theory of torsion and assumption – Torsion of circular shafts- solid & hollow – strain energy in torsion- Power transmission- Strength and stiffness of shafts- Types of springs- Stiffness stresses and deflection in helical spring- Columns – Buckling and stiffness due to axial loads – Euler, Rankin and Empirical formulae for columns with different conditions.

UNIT IV FLUID FLOW CONCEPTS AND DYNAMICS OF FLUIDS 12

Flow characteristics- Concepts of system and control volume –Continuity equation – Application of control volume to continuity – Energy Equation – Euler's Equation – Bernoulli equation and Momentum Equation – simple problems.

UNIT VDIMENSIONAL ANALYSIS AND FLOW THROUGH CIRCULAR CONDUITS **12**

Dimension and units, Buckingham's Π theorem- Boundary layer concepts- Boundary layer thickness- Darcy-Weisbach equation- Friction factor and Moody diagram-Commercial pipes- Minor losses- Flow though pipes in series and in parallel.

TEXTBOOKS:

1. Ramamurtham.S and Narayanan.R, "Strength of material", Dhanpat Rai Pvt. Ltd., New Delhi, 2001.
2. Bansal.R.K, "Strength of Material", Lakshmi publications Pvt. Ltd., New Delhi, 1996.
3. Kumar.K.L, "Engineering Fluid Mechanics", Eurasla publishers Home Ltd., New Delhi, 1995.
4. Bansal.R.K, "Fluid Mechanics and Hydraulic Machines" , Laxmi publications (P) Ltd., New Delhi, 1995.
5. Popov.E.P, "Mechanics of Materials", Prentice Hall, 1982.
6. Timoshenko.S.P and Gere .M.J, "Mechanics of Materials", C.B.S. publishers,1986.

REFERENCE:

1. Ferdinand P. Beer and Russell Johnston.E, "Mechanics of Materials", SI metric Edition McGraw Hill, 1992
2. Srinath.L.N, "Advanced Mechanics of Solids", Tata McGraw Hill Ltd., New Delhi.
3. Ramamurthan.S, "Fluid Mechanics and Hydraulics", Dhanpat Rai and Sons, Delhi, 1988.
4. Fox R.W and Mc. Donald .A.T, "Introduction to fluid Mechanics", 5th Ed. John Wiley and Sons, 1999

BMT301	**DIGITAL ELECTRONICS**										**L**	**T**	**P**	**C**
	Total Contact Hours - 45										3	0	0	3
	Prerequisite – Engg Mathematics-I, Engg Mathematics-III, Basic electronics													
	Course Designed by – Dept of Mechatronics													
OBJECTIVES To understand the basics concepts of number system and various digital logic designs														
COURSE OUTCOMES (COs)														
CO1	To learn different types logic gates													
CO2	To understand the Boolean algebra													
CO3	To understand the different types ofcombinational circuits													
CO4	To learn the sequential circuits and flip-flops													
CO5	To learn the Asynchronous sequential circuits.													
CO6	To learn the Algorithmic state machines.													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	
2	CO1	M	L		M	H	L	L						
	CO2	M	L		M	H	L	L						

	CO3	M	L		M	H	L	L					
	CO4	M	L		M	H	L	L					
	CO5	M	L		M	H	L	L					
	CO6	M	L		M	H	L	L					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I NUMBER SYSTEM AND BASIC LOGIC 10

Number systems-Binary, Octal, Hexadecimal, BCD, excess 3, complements conversions and arithmetic. Boolean theorems, Boolean algebra – AND, OR, NOT NAND & NOR operation, sum of product and product of sum forms. Minimization – Karnaugh's map, tabular minimization procedures.

UNIT II COMBINATIONAL CIRCUITS 10

Problem formulation and design of combinational circuits, adder / substractor, Encoder / decoder MUX/DEMUX, comparator, code converter.Design of combinational circuits, ROM, EPROM, EEPROM, introduction to PAL and PLA and their use in design.

UNIT III SEQUENTIAL CIRCUITS 10

Sequential circuits – SR, JK, D, T flip flops, triggering analysis of clocked sequential circuits, ripple counter, synchronous counters. Registers – shift registers, serial to parallel, parallel to serial conversions. Timing signal, RAM, semiconductor memories.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 8

Stable unstable states, output specifications, cycles and races, Race free assignments, reduction of state and flor tables, hazards, pulse mode sequential circuits.

UNIT V ALGORITHMIC STATE MACHINES 7

ASM chart-timing considerations-control implementation-design with multiplexers and PLA.

TEXTBOOKS:

1. Morris Mano M, "Digital Circuits and Logic Design", Prentice Hall of India, II Edition, 1996.

REFERENCE:

1. W.H.Gothmann, "Digital Electronics-Introduction Theory and Practice", PHI, 1992.2nd Edition.
2. T.L.Floyd, "Digital Fundamentals", PHI, 1986.10th Edition.
3. S.C.Lee, "Digital Circuits and Logic Design", PHI, 2000.
4. R.R. Jain, "Modern digital electronics", 4th edition, Tata McGraw-Hill, 3rd edition 2003.

5. Leach and Malvino, "Digital Principles of Electronics & Applications", Tata McGraw-Hill, 5th Edition, 2003.

BMT302	**ELECTRICAL MACHINES & DRIVES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engg Mathematics-I, Engg Mathematics-III, Basic electrical engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the basics concepts of various types of DC and AC machines with its drives

COURSE OUTCOMES (COs)

CO1	Able to get the basic knowledge about the Electric and Magnetic circuits, AC fundamentals and transformers.
CO2	Able to get the knowledge about the construction and working of DC, AC and Special machines.
CO3	Able to get the knowledge about the starting and speed control AC and DC machines.
CO4	Able to get the basic concepts of Drives, Electric drives, types and factors influencing the choice of electrical drives
CO5	To understand the working principle of DC &AC motors drives and their characteristics and its braking methods
CO6	To understand the concept of various application of electrical machines and its drives

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	L		M	H	L	L					
	CO2	M	L		M	H	L	L					
	CO3	M	L		M	H	L	L					
	CO4	M	L		M	H	L	L					
	CO5	M	L		M	H	L	L					
	CO6	L	L		L	M	L	L					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I CIRCUITS AND TRANSFORMERS 6

D.C. Voltage, current, power-Ohms law-series, parallel circuits – Kirchoff's laws – mesh analysis – A.C. voltage – sinusoidal waves, phasor representation – power factor – complex power - basic idea of transformers – simple problems.

UNIT II ELECTRICAL MOTORS 12

Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.

UNIT III SPEED CONTROL AND STARTING 9

Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems.

UNIT IV ELECTRICAL DRIVES 9

Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.

UNIT V SOLID STATE DRIVES (QUALITATIVE TREATMENT ONLY) 9

Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.

TEXTBOOKS:

1. S.K. Bhattacharya "Electrical Machines" Tata McGraw-Hill Pvt. Company Ltd., 3rd edition, 2008.

REFERENCE:

1. I.J. Nagrath, T.P. Kothari., "Basic Electrical Engineering", McGraw-Hill Publishing company Ltd., Second edition, 2002.
2. N.K.De., P.K.Sen "Electric Drives", Prentice Hall, First edition 1999.
3. G.K. Dubey "Fundamental Electrical Drives" second edition 2002, Narosa Publications, Second edition, 2002.
4. Pillai, S.K., "A Seish course on Electrical Drives", Wilay Eastern Ltd., New Delhi, 1982.

BMT3L1	**ELECTRONIC DEVICESAND ELECTRONIC CIRCUITS – LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Engg Mathematics-I, Basic electronics Lab				
	Course Designed by – Dept of Mechatronics				
OBJECTIVES					

To design an working of basic electronics circuits like power supply, oscillator, amplifier etc	
COURSE OUTCOMES (COs)	
CO1	To study the characteristics of diodes like PN diode and zener diode
CO2	To study the I/O characteristics of transistors in various configurations
CO3	To study the various characteristics of power transistors
CO4	To study the various characteristics of special transistors
CO5	To design and test rectifier circuits and series voltage regulators
CO6	To design and test amplifier, oscillator, multi-vibrator and clipper and clamper circuits

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H		H							
	CO2	M		H		H							
	CO3	M		H		H							
	CO4	M		H		H							
	CO5	M		H		H							
	CO6	M		H		H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Characteristics of PN junction and Zener diode.
2. Input and Output characteristics of CB, CE configuration.
3. Drain and Transfer characteristics of JFET.
4. Characteristics of SCR, Triac, Diac & UJT.
5. Half wave Rectifier & Full Wave rectifier.
6. Series voltage regulator.
7. Design of RC coupled amplifier &FET Amplifier.
8. Hartley Oscillator & Colpitt's oscillator.
9. Astable, Monostable, Bistable Multivibrator.
10. Clippers & clampers.

LIST OF EQUIPMENTS AND COMPONENTS

1. Variable Power Supply (0-30V) - 6
2. CRO - 4
3. Digital Multimeter - 6
4. Function Generator - 4
5. DC Ammeter - 4

Consumables

6. Transformers
7. Resistors ¼ Watt Assorted
8. Capacitors
9. Inductors
10. Diodes and Zener diodes
11. Bread Boards
12. ICS – 555, 741, LM 328, LM 324
13. BC107, BC147,BC 108, BC 148, BC547, BC 548, SL 100, SK100 or Equivalent transistors
14. Wires

BMT3L2	**ELECTRICAL MACHINES &DRIVES LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Engg Mathematics-I, Basic Electrical Lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES: The ability to conduct testing and experimental procedures on different types of electrical machines.

COURSE OUTCOMES (COs)

CO1	Understand the concept of efficiency and the short circuit impedance of a three-phase transformer from no-load test, winding resistance, short circuit test, and load test.
CO2	Understand the effect of unbalanced loading on a three-phase transformer with different connections, and the effects and limitations of each connection..
CO3	Understand the starting and connecting procedures of synchronous generators, and to obtain the 'V' curves of synchronous motors.
CO4	Experimentally obtain the load characteristics of various dc motors and generators
CO5	Experimentally obtain the load characteristics, starting current and starting torque of a squirrel-cage induction motor and to derive circuit parameters from no-load and blocked-rotor tests
CO6	Experimentally analysis the speed control of AC and DC machines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H				M		H	H		S	
	CO2	H		M	H	M	H	M			M		
	CO3							M	M	H			
	CO4		M	H	M			H				S	M
	CO5					H	M			M	S		S
	CO6	H	L		M	H			L	L			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Load test on D.C. shunt motor.
2. Speed control of D.C. shunt motor.
3. Swinburne's test
4. Load test on three phase induction motor.
5. No load and blocked rotor tests on three-phase induction motor.
6. Load test on single phase induction motor.
7. No load and blocked rotor tests on single phase induction motor.
8. Load test on Synchronous motors
9. Performance characteristics of Stepper motors.
10. Performance characteristics of single phase transformer.

LIST OF EQUIPMENT

(For a batch of 30 students)

S.No	Equipments	Qty
1.	Shunt motor 5HP	3
2.	Single phase Induction Motor 2HP	2
3.	Three phase induction Motor 5HP	2
4.	Single phase transformer 2KVA	1
5.	Three phase quto transformer	2
6.	Single phase auto transformer	2
7.	3 point starter	3
8.	DPST, TPST	Each 2
9.	DC source 300v, 100A	1
10.	Ammeter (0-5A), (0-10A) MC	Each 2
11.	Ammeter (0-5A), (0-10A) MI	Each 2
12.	Voltmeter (0-300V) MC	3
13.	Voltmeter (0-150V), (0-300V), (0-600V) MI	Each 2
14.	Wattmeter 150/300V, 5/10A UPF	2
15.	Wattmeter 300/600V, 5/10A UPF	2
16.	Wattmeter 150/300V, 5/10A LPF	2
17.	Wattmeter 300/600V, 5/10A LPF	2
18.	Stepper motor 5Kg	1
19.	Synchronous motor 5KW	1
20.	Rheostat 360 ohm/1.2A	3
21.	Rheostat 50 ohm/5A	3
22.	Tachometer	5

BMT3L3	COMPUTER AIDED MACHINE DRAWING	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Engg Mathematics-I, Engineering Graphics				
	Course Designed by – Department of Mechatronics				

OBJECTIVES

To understand the basics concepts of designing of various machine drawing

COURSE OUTCOMES (COs)

CO1	Able to get the basic knowledge about technical drawing standard and mechanical part drawing
CO2	Able to get the knowledge about various types of fitting with drawing representation
CO3	Able to get the knowledge about Drafting work using mini drafter
CO4	Able to get the basic concepts of dimensional and text writing in drawing
CO5	To understand the concept of drafting software and editing of drawing
CO6	To understand the concept of 2D drawing using CAD software

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	L		M	H	L						
	CO2	M	L		M	H	L						
	CO3	M	L		M	H	L						
	CO4	M	L		M	H	L						
	CO5	M	L		M	H	L						
	CO6	L	L		M	H	L						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT IBASICS OF ENGINEERING DRAW 9

Indian standard code of practice for engineering drawing – general principles of Presentation. Conventional representations of threaded parts, springs, gear and Common features. Abbreviations and symbols for use on technical drawings. Conventions for sectioning and dimensioning.

UNIT IIREPRESENTATION OF SYMBOL 9

Tolerances – types – representation of tolerances on drawing fits – types – selection of Fits – allowance. Geometric tolerances – form – and positional tolerances – datum, datum Features. Maximum material principle – symbols and methods of indicating it on drawing Surface finish

symbols – welding symbols and methods of indicating it on drawing.

UNIT III (Drafting work using mini drafter)PART AND ASSEMBLY DRAWINGS9
Preparation of part and assembly drawings of Plummer block, screw jack, machine vice, lathe tailstock, and tool head of the shaper, stuffing box, piston & connecting rod universal join)

UNIT IVINTRODUCTION TO DRAFTING SOFTWARE 9
Introduction to the use of any drafting software – creation of simple geometric bodies using primitives (line, arc, circle etc.,) and editing for the drawing, Dimensioning and text writing, concept of layer creation and setting, line types.

UNIT V2-D & 3-D DRAWINGS 9
Preparation of 2-D drawings using CAD software for components and assemblies of Plummer block, screw jack, machine vice, lathe tailstock, tool head of the shaper. Introduction to 3-D modeling solid and wire frame modeling.

TEXTBOOKS:
1. Sadhu Singh & P.L. Sah, Fundamentals of Machine Dynamics, Prentice Hall of India Pvt Ltd, 2003.
2. P.N. Rao, CAD/CAM Principles and Applications, Tata McGraw-Hill 2004. 2nd Edition.

REFERENCE:
1. K. Venugopal, Engineering Graphics AutoCAD, John Wiley & Sons, 2002. 4th Edition.

List Of Equipment And Software Required (for a batch of 30 students)
1. Computer System 30
VGA Color Monitor, Pentium IV Processor, 20 GB HDD, 256 MB RAM
2. Laser Printer 01
3. Plotter (A2 size) 01
4. Software: AutoCAD or Mechanical Desktop or Pro / E or CATIA or IDEAS 30 Licenses or Solidworks
5. Drawing Boards and Tables in Drawing Hall 30 Nos.

BMA402	**NUMERICAL METHODS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	2	0	4
	Prerequisite – Engineering Mathematics-I,II & III				
	Course Designed by – Dept of Mathematics				

OBJECTIVES
This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of the basic solutions of equations and Eigen value problems
CO2	Have a well-founded knowledge of standard numerical differentiation and integration which can describe real life phenomena.

CO3	Acquire skills in handling situations involving first and second order differential equations
CO4	Understand boundary value problems on ordinary and partial differential equations
CO5	Be able to analyze the interpolation techniques.
CO6	To learn finite difference solutions for one dimensional heat equations, one dimensional wave equation, Two dimensional, Laplace and Poisson equation.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H								
	CO4					H		H			H		
	CO5	H									M		
	CO6	H	H				M			M	M		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEM 9+6

Iterative method, Newton-Raphson method for single variable-solutions of linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss-Siedel methods, Inverse of matrix by Gauss-Jordan method, Eigen value of a matrix power and Jacobian methods.

UNIT II INTERPOLATION (FINITE DIFFERENCES) 9+6

Newton's Divide difference formula, Lagrange's interpolation-forward and backward difference formula-Stirling's Bessel's central difference formula

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson's (Both 1/3" and 3/8") rule, Double integrals using Trapezoidal and Simpson's rule.

UNIT IVINITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+6

Single step methods, Taylor series, Euler and modified Euler, Runge kutta method of first and second order differential equations, multiple step methods, Milne and Adam's –Bash forth predict and corrected method

UNIT V BOUNDARY VALUE PROBLEMS FOR ODE AND PDE 9+6

Finite difference for the second order ordinary differential equations, finite difference solutions for one dimensional heat equations (both implicit and explicit), one dimensional wave equation, Two dimensional, Laplace and Poisson equation.

TEXTBOOKS:

1. M.K.Venkatraman: Numerical Methods in Science and Engineering–NPC –Chennai.

REFERENCES

1. Jain.M.K.Iyengar, S.R.K.Andjain, RK Numerical methods for scientific and Engineering computation,(6^{th} edition, New age International publication,Co(2007))
2. Grewal.B.S.'Higher Engineering Mathematics' (43^{rd} edition) Khanna publisher, Delhi, 2014
3. http:// www.b-u.ac.in/sde_book/msc_mathnum.pdf

BME401	**DYNAMICS OF MACHINES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Mechanics, Mechanics of Solids				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

To introduce the concept of dynamics of machines. To acquaint the student with various techniques involved in dynamics and various new technology in dynamics of machines.

COURSE OUTCOMES (COs)

CO1	To learn the concept about force analysis for mechanism.
CO2	To understand the various methods of balancing in different situation.
CO3	To learn the Concept about free vibration of single degree of freedom.
CO4	To study the Concept about forced vibration of single degree of freedom.
CO5	To learn human population and the women and child welfare.
CO6	To learn the concept about critical speed of rotating shaft

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	S			M			L				
	CO2	H	S			M							
	CO3	H	S			M			L				
	CO4	H	S			M							
	CO5	H	S			M			L				
	CO6	H	S			M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I FORCE ANALYSIS OF MECHANISMS 12

Static, Inertia and combined force analysis- Graphical and analytical method- Slider crank mechanism and four bar mechanism. Turning moment diagram and flywheel-Applications in engine, Punching presses.

UNIT II BALANCING 12

Static and dynamic balancing-Balancing of rotating masses- Balancing of several masses in different planes.Primary and secondary unbalanced forces of reciprocating parts-Balancing of in line engines- Firing order- Balancing of 'V' and 'W' engines.

UNIT III FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEM 12

Fundamentals of vibrations-Undamped free vibrations of single d.o.f systems–Derivation & solution of differential equation-Torsional Vibrations-single rotor- Equivalent stiffness of spring combinations-Bifilar, Trifilar suspensions-Compound pendulum-Types of damping-Damped free vibrations of single d.o.f-over, critical, under damped- Damping coefficient - Critical damping coefficient-Logarithmic decrement

UNIT IV FORCED VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS 12

Forced vibrations with-Constant harmonic excitation-Rotating & Reciprocating unbalance-Excitation of the support-Energy dissipated by damping-Forced vibrations with couloumb, viscous damping-Vibration Isolation and Transmissibility- Vibration Absorbers

UNIT V CRITICAL SPEEDS AND SHAFTS WITH ROTORS 12

Lateral vibration of beams - Whirling speed of shaft - Shafts with two & three rotors-Geared system. Dunkerly's method for different types of beams & shaft with several loads.

TEXTBOOKS:

1. S.S.Rattan-Theory of Machines- Tata McGraw Hill(4th Edition), 2014.
2. Singh.V.P. Mechanical Vibrations-Dhanpatrai & co (p) Ltd(4th edition), 2010

REFERENCES

1. Rao.J.S. and Dukkipatti, Mechanism and Machines Theory, 2nd Edition-Wiley Eastern Ltd, 2007.
2. Balaguru.S. Dynamics of Machinery, Sci Tech Publications (India) Pvt Ltd, 2011.
3. Grover.G.K. Mechanical Vibrations- Nemchand & Bros.(8th Edition), 2012
4. https://books.google.co.in/books?isbn=1259051285.

BMT401	MANUFACTURING TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic mechanical engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To Understand the various concept of manufacturing technology to produce new product and to acquaint the student with various manufacturing technologies used in production engineering.

COURSE OUTCOMES (COs)

CO1	To learn different types of foundry technology
CO2	To understand the different types offorming– processes
CO3	To learn the material removal processesand machine (i.e. lathe)
CO4	To learn the material removal processesand machine **(**i.e. milling)
CO5	To learn the principles & applications of joining processes.
CO6	To Understand Principles and applications of Brazing and Soldering.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M			H	H							
	CO2					H							
	CO3		M		H	H							
	CO4				M	H							
	CO5					H							
	CO6	M			M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I FOUNDRY TECHNOLOGY 9

Pattern and Core making – Molding sand – Melting furnaces Cupola and Induction furnaces – Special casting processes – Shell, Investment, Die casting – Defects in casting.

UNIT II FORMING– PROCESSES 9

Hot and Cold Working

Rolling: Introduction – Rolling Mills – Rolling Operations – Production of Seamless Tubing and Pipe.

Forging : Introduction – Related Forging Operations – Drop forging

Extrusion and Drawing: Extrusion Practice – Hot, Cold, Impact and Hydrostatic extrusion. Drawing Process – Defects and Residual Stresses – Drawing Equipment.Sheet metal operations – Blanking, Punching and Piercing.

UNIT III MATERIAL – REMOVAL PROCESSES 9

Lathes and Lathe Operations, Drilling and Drilling Machines, Reaming and Reamers, Tapping and Taps – Tool nomenclature, cutting speed, feed, machining Time calculations.

UNIT IV MATERIAL – REMOVAL PROCESSES 9

Milling Machines and Operations, Planning and Shaping, Broaching, Gear Hobbing and Shaping.

Grinding Process – Abrasives – Finishing Operations – Lapping, Honing Powder coating.

UNIT V PRINCIPLES & APPLICATIONS OF JOINING PROCESSES 9

Gas welding, Basic Arc Welding Processes, Thermit Welding, Electron – Beam Welding, Laser – Beam Welding. Solid State Welding: Cold Welding, Ultrasonic Welding, Friction Welding, Resistance Welding and Explosive Welding. Principles and applications of Brazing and Soldering.

TEXTBOOKS:

1. KALPAKJIAN, S., "Manufacturing Engineering and Technology", Pearson education India, 7th edition, 2015 (**SBN-13:** 978-9814514828)

REFERENCES

1. Hajra Choudhury, S.K., and Haqjra Choudhury, A.K., "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 2010.
2. Paul Degarma E, Black J.T. and Ronald A. Kosher, Eighth edition, Materials and Processes in Manufacturing Prentice – Hall of India, 2011.
3. Sharma P.C. A Textbook of Production Technology, S. Chand and Co., Ltd., 2007.
4. https://books.google.co.in/books?isbn=8185099154, 1118163737, 8121911141.

BEE404	POWER ELECTRONICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Electronics engineering, Basic electrical Engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To get an overview of different types of power semi-conductor devices and to understand parameters of controlledrectifiers, inverters, AC voltage controller and cycloconverters.

COURSE OUTCOMES (COs)

CO1	To learn different types of power semi-conductor devices and their characteristics.
CO2	To understand the operation, characteristics and performance parameters of controlled rectifiers
CO3	To study the operation, switching techniques and basic topologies of DC-DC converters.
CO4	To learn the operation of different types of inverters like VSI, CSI, PWM Inverters, Series inverter and parallel inverter.
CO5	To study the operation of AC voltage controller and cycloconverters.

CO6	To study the Principle of operation step up and step down chopper												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	L			H	H			
	CO2	H	H	H	H	H			H	H			
	CO3	H	H	H	H	H			H	H			
	CO4	H	H	L	H	M			H	H			
	CO5	M	M	H	H	H			H	H			
	CO6	H	H	H	H	H			H	H			
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I POWER SEMI CONDUCTOR DEVICES

9Principle of operation – Characteristics of power diodes, SCR, TRIAC, GTO, Power BJT, Power MOSFET and IGBT – Thyristor protection circuits.

UNIT II PHASE CONTROLLED CONVERTERS **9**Single phase full converters, 3 phase half converter and 3 phase full converter – inverter operation – input power factor – effect of source inductance – Thyristor triggering circuits.

UNIT III DC TO DC CHOPPERS **9**

DC Chopper – Principle of operation – step up and step down chopper – Forced commutation – different techniques – voltage, current and load – commutated choppers – step up and step down chopper.

UNIT IV INVERTERS **9**

Voltage source inverters – series, parallel and bridge inverters – PWM inverters – current source inverters.

UNIT V AC VOLTAGE CONTROLLERS AND CYCLOCONVERTERS **9**

Single phase AC voltage controller – multistage sequence control – step up and step down cycloconverters – three phase to single phase and three phase cycloconverters.

TEXTBOOKS:

1. Reshid, M.H., "Power Electronics – Circuits Devices and Application" Prentice Hall International, New Delhi, 3rd Edition, 2011.

REFERENCES

1. Lander, W., "Power Electronics" McGraw-Hill and Company, 4th Edition, 2009.
2. Singh, M.D., Khanchandani, K.B., "Power Electronics", Tata McGraw-Hill, 2008.
3. Dubey, G.K., Doradia, S.R., Joshi, A. and Singh, R.M., "Thyristorised Power Controllers", Wiley Eastern Limited, 2005.
4. Joseph Vithayathil, "Power Electronics – Principle and Applications", and Robbins, "Power Electronics", McGraw-Hill Inc, New York, 2006.
5. Mohan Undeland and Robbins, "Power Electronics", John Wilry and Sons, New York, 2011.
6. https://books.google.co.in/books?isbn=8184317212, 0070583897, DttqSQAACAAJ

BEI402	CONTROL SYSTEMS	L	T	P	C
	Total Contact Hours - 45	4	0	0	4
	Prerequisite – Engg Mathematics-I, Engg Mathematics -III, Basic Electronic Engineering, Basic Electrical Engineering.				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To provide an introduction to the analysis of linear control systems. This will permit to exploit time domain and frequency domain tools.

COURSE OUTCOMES (COs)

CO1	To learn the concept of System and their representation.
CO2	To understand the Concept of time response analysis.
CO3	To learn the Concept of frequency response analysis.
CO4	To study the various methods for stability of the systems.
CO5	To learn the various types of compensation techniques.
CO6	To Understand Transient response analysis, Root locus, Bode diagrams, Nyquist plots with MATLAB

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			M							
	CO2	H	H	L		M							
	CO3	H	H		L	M							
	CO4	H	H			M							
	CO5	H	H			M							
	CO6	H	H			M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in control systems – open and closed loop systems Examples – Mathematical model, Translational & Rotational systems – transfer function – block diagram reduction techniques – signal flow graph.

UNIT II TIME RESPONSE 9

Time response – time domain specifications – types of test inputs – I and II order system response – error coefficients – generalized error series – steady state error – P, PI, PD, PID Controller characteristics.

UNIT III FREQUENCY RESPONSE ANALYSIS AND DESIGN 9

Performance specifications – correlation to time domain specifications – Bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

UNIT IV STABILITY OF CONTROL SYSTEMS 9

Characteristic equation – location of roots in s-plane for stability – Routh Hurwitz criterion – root locus techniques – construction – gain margin and phase margin – Nyquist stability criterion.

UNIT V COMPENSATION DESIGN 9

Design concepts – realization of basis compensation – cascade compensation in time domain and frequency domain (simple MATLAB applications to analysis and compensators design problems.)

TEXTBOOKS:

1. M. Gopal, "*Control Systems: Principles and Design*", 3rd Edition, McGraw, Hill, 2014.

REFERENCE:

1. Katsuhiko Ogata, "Modern Control Engineering" 5th Edition, Prentice Hall of India Private Ltd., New Delhi, 2012.
2. ChesmondC.J. "Basic Control System Technology", Viva Low Priced Student Edition, 2012.
3. Datton K., Banaclough W. and Thompson S., "The Art of Control Engineering", Addison Wesley 2005.
4. R.C. Dorf and R.H. Bishop, "Modern Control Systems", 12th Edition, Prentice, Hall, 2010.
5. Leonard N.E. and William Levine, "Using MATLAB to Analyze and Design Control Systems", Addision Wesley (2nd edition), 2006.
6. http//www.controlsys.com

BCE406	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.

4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H	H	S		S			M
	CO2	M					H						
	CO3						H						M
	CO4	M								S			
	CO5			M			M	S				S	M
	CO6	M		M			M	S		S		M	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –

Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, 1989.
4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BMT4L1	**MANUFACTURING TECHNOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Mechanical and Civil lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

Study of various types of lathe operations. To produce various shapes using machines and gear shape

COURSE OUTCOMES (COs)

CO1	To practices on lathe machines and make different shapes.
CO2	To practices on making holes using drilling machine.

CO3	To practices on surface finish using milling machine.												
CO4	To practices on making key ways and dove tail machining.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				H	M	L						
	CO2				H	M	L						
	CO3				H	M	L						
	CO4				H	M	L						
	CO5												
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

UNIT 1 LATHE PRACTICE

a. Plain Turning b. Taper Turning c. Thread Cutting

Estimation of machining time for the above turning processes.

UNIT II DRILLING PRACTICE

a. Drilling, b. Tapping c. Reaming

UNIT III MILLING

a. Surface Milling,b. Gear Cutting c. Contour Milling

UNIT IV PLANNING AND SHAPING

a.Cutting Key Ways, b. Dove tail machining.

LIST OF EQUIPMENT(for a batch of 30 students)

1. Lathe - 15 Nos.
2. Drilling Machine - 1 Nos.
3. Milling Machine - 2 Nos.
4. Planning Machine - 1 Nos.
5. Shaping Machine - 2 Nos.

BMT4L2	MACHINE DYNAMICS LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Fluid Mechanics and Machinery lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To learn about Governors /CAM, Motorized Gyroscope and Vibrating system Spring mass.

COURSE OUTCOMES (COs)

CO1	To learn&Pratices about Governors /CAM
CO2	To Learn &Practice The Experiments Like Gyroscope
CO3	To Learn &Practice The Experiments Like Vibrating System Mass.
CO4	To Learn &Practice The Experiments Like Determination of Moment of inertia

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M			H			H	H		
	CO2			M			H			H	H		
	CO3			M			H			H	H		
	CO4			M			H			H	H		
	CO5												
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for watt, porter, proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorized Gyroscope-Verification of law's -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of Moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system spring mass-system-Determination of damping co-efficient of single degree of freedom system.
9. Determination of influence co-efficient for multi degree freedom suspension system.
10. Determination of transmissibility ratio - vibrating table.

11. Determination of tensional frequencies for compound pendulum and flywheel -system with lumped Moment of inertia
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

LIST OF EQUIPMENT (for a batch of 30 students)

1. Cam analyzer. - 1 No
2. Motorized gyroscope. - 1 No.
3. Governor apparatus - watt, porter, proell and hartnell governors. - 1 No.
4. Whirling of shaft apparatus. - 1 No.
5. Dynamic balancing machine. - 1 No.
6. Static and dynamic balancing machine. - 1 No.
7. Vibration test facilities apparatus - 1 No.

BEE4L2	**POWER ELECTRONICS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Basic Electrical & Electronics lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES: To practice SCR, MOSFET, UJT, TRIAC and the SCR converters

COURSE OUTCOMES (COs)

CO1	To Study the SCR, MOSFET & IGBT characteristics
CO2	To learn & practice the SCR phase control circuit
CO3	To learn & practice TRIAC phase control circuit
CO4	To learn & practice SCR single-phase cyclo converter & SCR series and parallel inverters
CO5	To Study & practice IGBT Chopper & IGBT based PWM inverter (single phase)
CO6	To Study of three phase AC regulator module

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M			H			H	H		
	CO2			M			H			H	H		
	CO3			M			H			H	H		
	CO4			M			H			H	H		
	CO5			M			H			H	H		
	CO6			M			H			H	H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

LIST OF EXPERIMENTS

1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR phase control circuit
5. TRIAC phase control circuit
6. Study of half controlled & fully controller converters
7. Study of three phase AC regulator
8. Speed controls of DC shunt motor using three phase fully controlled converter.
9. SCR single-phase cyclo converter
10. SCR series and parallel inverters
11. IGBT Chopper
12. IGBT based PWM inverter (single phase)

LIST OF EQUIPMENT (for a batch of 30 students)

S.No	Equipments	Qty
1	Study of SCR, MOSFET & IGBT characteristics module IJT, R, RC firing circles for SCR module Voltage & current commutated chopper module	1
2	SCR phase control circuit module	1
3	TRIAC phase control circuit module	1
4	Study of half controlled & fully controller converters	1
5	module	1
6	Study of three phase AC regulator module	1
7	Speed control of DC shunt motor using three phase fully	
8	controlled converter module SCR single phase cyclo converter module	1
9	SCR series and parallel inverters module IGBT chopper module	1
10	IGBT based PWM inverter (single phase) module	1
11	Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI	1
12	Voltmeter (0-300V) MC, (0-600V) MC,	1
13	(0-300V) MI, (0-600V) MI	Each 3
14	Multimeter CRO	Each 3
15	Transformer 1KVA, 1:1, 230V	4
16	CRO Transformer 1KVA, 1:1,230V	5

	TECHNICAL SEMINAR	L	T	P	C
	Total Contact Hours -30	0	0	2	1

BMT4S1	Prerequisite – Basic English knowledge
	Course Designed by –Dept of Mechatronics
OBJECTIVE: To improve the communication skills of the students.	
COURSE OUTCOMES (COs)	
CO	To improve the communication skills of the students

During the Seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

BMT501	**THERMODYNAMICS PRINCIPLES AND APPLICATIONS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Chemistry, Engineering Physics, Fuel Mechanics Machinery				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

The purpose of this course is to introduce the undergraduate students with the basic concepts about laws of thermodynamics, air standard cycles, air compressors, vapor power and vapor compression cycles along with conduction heat transfer and convection and radiation heat transfer.

COURSE OUTCOMES (COs)

CO1	To learn the basics about first law and second law of thermodynamics.
CO2	To learn air standard cycles and air compressor working principles.
CO3	To analyze a vapor power cycle given a set of operational parameters and constraints.
CO4	To learn the conduction heat transfer.
CO5	To learn the convection and radiation heat transfer.
CO6	To Understand the concept of heat exchangers

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5	H									H		
	CO6							M		H	H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I FIRST LAW OF THERMODYNAMICS 12

Thermodynamics – microscopic and macroscopic point of view – systems, properties, process, path, cycle. Units – pressure, temperature – Zeroth law. First law – application to closed and open systems, internal energy, specific heat capacities CV and CP – enthalpy

UNIT II SECOND LAW OF THERMODYNAMICS 12

SecondLaw of thermodynamics – statements – equivalents of Kelvin Plank and Clausius statements. Reversibility – Irreversibility, reversible cycle – Carnot cycle and theorem

UNIT III INTERNAL COMBUSTION ENGINES 12

Classification of IC engine - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, Comparison of petrol & diesel engine, Fuel supply systems, total fuel consumption, specific fuel consumption, mechanical efficiency, BHP, IHP, FP - Ignition Systems, Lubrication system, Cooling system, MPFI, DTSI, CRDI.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 12

Principles of refrigeration, refrigerator& heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychrometric chart, humidification, de-humidification, air coolers, cooling towers.

UNIT V HEAT TRANSFER (Qualitative Treatment Only) 12

Heat transfer through conduction and convection, Fourier's law of conduction - Problems on one dimensional heat conduction through plain walls, composite walls, cylinder walls, spheres. Extended surfaces: Fins. Problems on heat transfer through rectangular fin, triangular fin, circumferential fin, pin fin, fin efficiency, fin effectiveness. Heat transfer through radiation, Stefan Boltzman Law, black body, grey body, shape factor. Types of Heat Exchangers.

TEXTBOOKS:

1. Nag P. K, 'Engineering Thermodynamics' Tata McGraw-Hill(5 th edition), 2013.

REFERENCES

1. Michael A. Boles, Yunus A. Cengel, YunusCengel, "Thermodynamics", 7 th Edition, Mc Graw-Hill India, 2011.
2. Kothandaraman. C.P., Domkundwar. S. & Domkundwar.A.V., "A course in ThermalEngineering" Dhanpatrai & Co (P) Ltd, Fifth edition, 2010.

3.Kothandaraman. C.P., "Heat and Mass Transfer", New Age International (P),8th edition reprint Feb 2014.
4. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2002.

BEC501	**MICROPROCESSORS &ITS APPLICATIONS**										**L**	**T**	**P**	**C**
	Total Contact Hours - 45										3	0	0	3
	Prerequisite – Basic Electronics Engineering													
	Course Designed by – Dept of Electronics Engineering													

OBJECTIVES

To introduce the architecture of 8085, interfacing of 8085,designing of input output devices

COURSE OUTCOMES (COs)

CO1	To learn basics about 8085 block diagram.
CO2	To understand the different types input output devices.
CO4	To learn matrix keyboard& digital transmission.
CO5	To understand the applications of 8085.
CO6	To know about real time applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5	H									H		
	CO6							M	M			H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 10

Organization of Micro Computers – Organization of 8085: Architecture, Internal Register Organization and Pin Configuration – Instruction Set of 8085 – addressing modes - instruction and machine cycles with states and timing diagram. Methods of 8085 programs and 8085 assembly language.

UNIT II INTERFACING AND I/O DEVICES 9

Need for Interfacing – Memory Interfacing: address space partitioning – address map – Address decoding – Designing decoder circuit for the given address map – Bus connection and Z – line Control – Access Time Computations.I/O Interfacing: Data transfer schemes – programmed Synchronous and asynchronous – Interrupt driven Transfer – Multiple devices and multiple interrupt levels – enabling disabling and masking of interrupts.DMA transfer: Cycle stealing – Burst mode – Multiple DMA devices – DMA transfer in 8085 system – serial data transfer.

UNIT III INTERFACING DEVICES 9

Programmable peripheral device – programmable interval timer (8253) – Programmable communication interface (USART) – Programmable interrupt controller – Programmable DMA Controller (8257) – Programmable Keyboard/ display controllers.

UNIT IV DESIGN USING PERIPHERAL DEVICES 9

Interfacing A/D and D/A converters – Matrix Keyboard design using 8255 using 8085 programs. Designing real time clock, detecting power failure, detecting presence of objects using 8253 – Design of Keyboard and display interfacing using 8279 – Design of digital transmission with modems and telephone lines using 8251 A.

UNIT V MICROPROCESSOR APPLICATIONS 8

Temperature monitoring system – Automotive applications – Closed loop process control – Stepper motor control.

TEXTBOOKS:

1. Introduction to Microprocessor – Third Edition – Aditya P Mathur, Tata McGraw- Hill Publishing Company Ltd., New Delhi 3rd Edition 2008.

REFERENCES

1. Microprocessor Architecture. Programming and Applications with the 8085 Ramesh Goankar, fifth edition- Penram International Publishing (India) Private Limited.
2. "Microprocessors and Interfacing, Programming and Hardware" Douglas V.Hall. Tata McGraw–Hill Publishing Company Ltd., (3rd edition) New Delhi, 2008.

BMT503	**INSTRUMENTATION & CONTROL**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –control system				
	Course Designed by – Dept of Electronics & instrumentation Engineering				

OBJECTIVE

To introduce the various instrumentation involved in the industry, and to introduce the current trends in the various types of instrument.

COURSE OUTCOMES (COs)

CO1	To learn general concept of measurement
CO2	To understand the different types ofTemperature Measurements
CO3	To learn the different types of Pressure, Flow and Level Measurements

CO4	To learn the different types of Displacement, Force and torque Measurements												
CO5	To learn the concept of pneumatic and electronic PID controller												
CO6	To Understand the concept of controllers in measurement												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H High, M-Medium, L-Low -													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5	H									H		
	CO6					M				H	H		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I :GENERAL CONCEPTS OF MEASUREMENT 9

Generalized Measurement System – Performance Characteristics – Static and Dynamic Characteristics – Errors in Measurements – Calibration and Standards – Generalized Performance of Zero Order, First Order and Second Order Systems – Classifications of Transducers.

UNIT II :TEMPERATURE MEASUREMENT 9

Mechanical Type – Filled Thermometers – Liquid Filled – Gas Filled – Vapour Filled – Bimetallic Thermometer – Electric Type – RTD – Thermistor, Thermocouple, IC Thermometer – Non Contact Total Radiation Pyrometer – Optical Pyrometer.

UNIT III: PRESSURE, FLOW AND LEVEL MEASUREMENTS 9

Pressure: Monometers – Elastic Transducers – Bourdon Gauge – bellows – diaphragm – Calibration of Pressure Gauge using Dead Weight Testers. Vaccum: McLeod Gauge, Thermal Conductivity Gauge – Ionization Gauge. Flow Measurement: Orifice, Venturi, Nozzle, Pitot tube, Turbine Flow meter, Hot wire Anemometer.Level Measurement: Float Level, surge type, Differential Pressure Type, Electrical Type- Resistance and Capacitance.

UNIT IV: DISPLACEMENT, FORCE, TORQUE & VIBRATION MEASUREMENT9

Load Cells – Different Types – Potentiometer – Strain Gauges Resistive and Semiconductor – Different Forms – Measurement Circuits – Use in Displacement, Force and Torque Measurement. LVDT Characteristics – Measurement Circuits – Use in Displacement - RVDT for

angular measurement.Piezo Electric Transducer – Different Types – Characteristics – Measurement Circuits – Application in Acceleration and Vibration Measurement.Optical Encoder for Displacement and Velocity Measurement.

UNIT V :PNEUMATIC AND ELECTRONIC PID CONTROLLERS 9

Pneumatic and Electronic PID Controllers – Automatic Speed Control of Drives- Pneumatic Two Step Controller – Machine Tool Control.

TEXTBOOKS:

1. Ernest O. Doebelin, "Measurement Systems Application and Design", McGraw-Hill Publishing Company, 5th Edition, 2006.

REFERENCES

1. Beckwith, T.G. and Buck, N.L. "Mechanical Measurements" Addition Wesley Publishing Company Limited, 1995.
2. Jain R.K. "Mechanical and Industrial Measurements" Khanna Publishers, Delhi, 1999.
3. Rangan, Mani and Sharma, "Instrumentation", Tata McGraw-Hill Publications, New Delhi,(2nd edition) 1989.
4. Nagrath I. G. and Gopal, M. "Control Systems Engineering", Wiley Eastern Limited, (5th edition) 2000.
5. Murthy "Transducers and Instrumentation Printing Hall of India", New Delhi, 2003.

BMT502	CNC TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Engineering Machanics,Basic Mechanical Engineering				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVE

To introduce the CNC technology for to production of product sand to learn the student with various CNC technology used in production engineering. To introduce the industrial current trendsin the production technology.

COURSE OUTCOMES (COs)

CO1	To introduce the fundamentals of CNC Technology.
CO2	To understand the constructional features and retrofitting of CNC machines.
CO3	To learn the types of controls system, various feedback devices and tooling.
CO4	To practice writing programs using G codes and M Codes.
CO5	To learn the economics and maintenance of CNC installation.
CO6	To know about real-time applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									

	CO3	M			H						M		
	CO4					H		H					
	CO5												
	CO6							H			H	H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I FUNDAMENTALS OF CNC MACHINES 9

Introduction to Computer Numerical Control: CNC Systems – An Overview of Fundamental aspects of machine control, Different types of CNC machines – Advantages and disadvantages of CNC machines.

UNIT II CONSTRUCTIONAL FEATURES OF CNC MACHINES AND RETROFITTING 10

Features of CNC Machines: Structure, Drive Mechanism, gearbox, Main drive, feed drive, Spindle Motors, Axes motors. Timing belts and pulleys, Spindle bearing – Arrangement and installation. Slide ways. Re - circulating ball screws – Backlash measurement and compensation, linear motion guide ways. Tool magazines, ATC, APC, Chip conveyors.Retrofitting of Conventional Machine Tools: Modification to be carried out on conventional machines for retrofitting.

UNIT III CONTROL SYSTEMS, FEED BACK DEVICES AND TOOLING 10

Description of a simple CNC control system.Interpolation systems. Features available in a CNC system – introduction to some widely used CNC control systems. Types of measuring systems in CNC machines – Incremental and absolute rotary encoders, linear scale – resolver – Linear inductosyn – Magnetic Sensors for Spindle Orientation. Qualified and pre-set tooling – Principles of location – Principles of clamping – Work holding devices.

UNIT IV CNC PART PROGRAMMING 9

Part Program Terminology-G and M Codes – Types of interpolation Methods of CNC part programming – Manual part programming – Computer Assisted part programming – APT language – CNC part programming using CAD/CAM-Introduction to Computer Automated Part Programming.

UNIT V ECONOMICS AND MAINTENANCE 7

Factors influencing selection of CNC Machines – Cost of operation of CNC Machines – Practical aspects of introducing CNC machines in industries – Maintenance features of CNC Machines – Preventive Maintenance, Other maintenance requirements.

TEXTBOOKS:

1. Yorem Koren, "Computer Control of Manufacturing Systems", McGraw Hill, 2000.

REFERENCES

1. Radhakrishnan P., Computer Numerical Control Machines, New Central Book Agency, 2000.
2. BERRY LEATHAM – JONES, Computer Numerical Control, Pitman, London, 1987.
3. STEAVE KRAR and ARTHUR GILL, CNC Technology and Programming, McGraw–Hill Publishing Company, 1990.
4. HANS B.KIEF and T.FREDERICK WATERS, Computer Numerical Control Macmillan/McGraw-Hill, 1992.
5. G.E.THYER, Computer Numerical Control of Machine Tools. Second Edition, B/H NEWNES, 1993.
6. GROOVER, M.P., Automation, Production Systems and Computer Integrated Manufacturing, Prentice Hall (3rd Edition), 2008.
7. MIKE MATTSON, "CNC Programming Cengage Learning, 2009.

BMT504	**DIMENSIONAL METROLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours -45	3	0	0	3
	Prerequisite – Engineering Physics				
	Course Designed by – Dept of Mechatronics				

OBJECTIVETo introduce concept of metrology and measurement, measurement systems, metrological equipments.

COURSE OUTCOMES (COs)

CO1	To explain theconcept of metrology and measurement and various terms used in the metrology
CO2	To understand the vernier caliper, micrometer and gauge block
CO3	To explain the measurement by comparison
CO4	To explain the optical metrology
CO5	To explain the surface measurement
CO6	To Understand the concept non contact type measurement

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5												
	CO6										H	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I BASICS OF MEASUREMENT & METROLOGY 9

Measurement & Metrology – Introduction, uses, acts and applications of measurement, codification of measurement – Accuracy, precision and reliability – Evolution of standards – metric systems – fundamental & Practical Criteria – metrological, communication and computational considerations – Rounding of numerical values. Measurements and Tolerances – Geometric Dimensioning and Tolerance – Statistics and metrology – probability and acceptance sampling.

UNIT II MEASUREMENT INSTRUMENTS 9

Measurement with scales and scaled Instruments – steel rule – role of error – calipers – types and applications.Vernier Instruments – Vernier Caliper, Depth gauge, Height gauge – height master – Three elements of measurements. Micrometer Instruments – Principle, Types, applications.Development and use of gauge blocks – Calibration, applications, combining gauge blocks.

UNIT III MEASUREMENT METHODS 9

Measurement by comparison – Dial Indicator – Principle, selection, use and Calibration – Accessories and attachments – constructive use of Error. High – Amplification comparators – Electronic measurement – applications – advantages of multiple scales. Pneumatic measurement – Principles, applications and advantages of pneumatic comparators – Calibration – Role of error, Calibration Procedure.

UNIT IV OPTICAL MEASUREMENT METHODS 9

Optical Flats and Optical alignment – light waves as standards – measurement with optical flats, applications of optical flat measurement – principles of optical metrology – Alignment Telescope – Straightness measurement – Optical squares and squareness measurement – Sight level – Plumbness, optical polygons – Angles, Jig Transit – Planes, Theodolite Angles and planes. Reference planes-Flatness, Perpendicularity and modern reference planes. Angle measurement-Basic geometry function, sign bars and plates and mechanical angle measurements.

UNIT V SURFACE MEASUREMENT METHODS 9

Surface Measurement – surface Evaluation, stylus method, Numerical values for surface Assessment, surface Texture specimens, surface Evaluation, other methods, Roundness measurement. Coordinate measuring machines – types, operational details and metrological features – coordinate systems. Non-contact type measurement – Principles of microscope, applications, optical comparator, profile projector, machine vision systems, Laser measurement.

TEXTBOOKS:

1. Connie Dotson, Ronger Harlow and Richard L. Thomson, "Fundamentals of Dimensional Metrology", 5th Edition, 2009. Thomson Asia Pvt. Ltd. Singapore. ISBN 981-243-685-5.

REFERENCES

1. R.K. Jain, "Engineering Metrology", Khanna Publishing, 2002.
2. Gaylor, Shotbolt and Sharp, "Metrology for Engineers, O.R. Cassel, London, 1993.
3. Thomas, "Engineering Metrology", Butthinson & Co., 1984.

BEC5L2	**MICROPROCESSORS LAB**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									0	0	3	2
	Prerequisite -Basic Electronics Engineering												
	Course Designed by – Dept of Electronics Engineering												
OBJECTIVESTo understand 8085 basics and practice various programs in the laboratory.													
COURSE OUTCOMES (COs)													
CO1	To learn about basic programming using 8085.												
CO2	To learn about ascending/descending order.												
CO3	To study about interfacing devices.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M			H	M		
	CO2	M					H			M			
	CO3			H							M		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	**Non-Major Elective (NE)**	**Open Elective (OE)**		Project/Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EXPERIMENTS

I. **PROGRAMMING** 30

1. Addition of two 8-bit numbers, sum of 8-bits and 16 bits.
2. Decimal addition of two 8-bit numbers Sum: 16 bits.
3. 8-bit subtraction.
4. 8-bit decimal subtraction.
5. Additional of two 16-bit numbers, Sum: 16 bits or more.
6. Multibyte subtraction.

7. To arrange a series of numbers in Ascending order
8. To arrange a series of numbers in Descending order
9. 8-bit Multiplication.
10. 8-bit Division.
11. Decimal to hexadecimal conversion and hexadecimal number to decimal number conversion.

II. **INTERFACING** 30

1. Analog to digital conversion
2. Digital to analog conversion
3. Stepper motor controller.
4. Temperature controller

LIST OF EQUIPMENT
(for a batch of 30 students)

S.No	Equipments	Qty
1	8085 Microprocessor trainer kits	15
2	ADC interface card	3
3	DAC interface card	3
4	Stepper motor interfacing card with stepper motor	3
5	Temperature controller with sensors like thermocouple	3

BMT5L1	**INSTRUMENTATION & CONTROL LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Basic Instrumentation engineering				
	Course Designed by – Dept of Electronics& communication Engineering, Department of Electronics &instrumentation engineering				

OBJECTIVES

To introduce the concept of various instrument involved in industry with various practical concepts in instrumentation and control and to introduce the various advanced technology in controlling technique.

COURSE OUTCOMES (COs)

CO1	To learn the practical experiments about pressure measurement and control
CO2	To understand the practical experiments about force and torque measurement
CO3	To learn the practical experiments about temperature measurement and control
CO4	To learn the practical experiments about speed measurement and control
CO5	To learn the practical experiments about application of data acquisition system for industrial purposes

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	S							
	CO2				M	S							
	CO3				M	S							
	CO4				M	S							
	CO5				M	S							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. PRESSURE MEASUREMENT AND CONTROL
   Pressure measuring devices – Pressure and vacuum gauge calibration.
2. TEMPERATURE MEASUREMENT AND CONTROL
   Temperature measuring devices like platinum resistance thermometer, thermocouple, radiation pyrometer, etc.
3. SPEED MEASUREMENT AND CONTROL
   Studying the devices and characters and measuring the speed using tachometer, stroboscope, etc.
4. FORCE MEASUREMENT
   Force measuring devices, load cells and proving rings.
5. TORQUE MEASUREMENT
   Torque measurement –using torque measuring devices.
6. POWER MEASUREMENT
   Power measurement using prony brake.
7. STRAIN MEASUREMENT
   Study and use of strain – strain gauge indicator.
8. DISPLACEMENT MEASUREMENT
   LVDT-Displacement and velocity measurement using encoders.
9. SOUND MEASUREMENT
   Measurement of sound level using sound level meters.
10. Study on the application of data acquisition system for industrial purposes.

BMT5L2	**CNC LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours -45	0	0	3	2
	Prerequisite – Basic Mechanical Engineering				
	Course Designed by – Dept of Mechanical Engineering, Dept of Mechatronics Engineering				

OBJECTIVE

To teach part programming in the CNC machines and produce various shapes CNC machine.

COURSE OUTCOMES (COs)	
CO1	To explain theconcept of metrology and measurement and various terms used in the metrology
CO2	To practices on programming and simulation of machining
CO3	To practices on Linear and Circular interpolation
CO4	To practices on Pocket milling, slotting, peck drilling and other fixed canned cycles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	M								
	CO2			H	M								
	CO3			H	M	L							
	CO4			H	M								
	CO5												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Manual part programming using G and M codes for Turning, step turning, Taper turning, thread cutting and radius turning on cylindrical components.
2. Programming and Simulation of machining using the following features.
   a. Linear and Circular interpolation
   b. Pocket milling, slotting, peck drilling and other fixed canned cycles.
3. Given a component drawing to write the manual part programming and execute on CNC Lathe and Milling Machine.

LIST OF EQUIPMENT (for a batch of 30 students)

1.CNC Lathe with Fanuc controller - 1 No.
2. CNC Milling Machine with Fanuc controller- 1 No.
3. Master CAM software - 10 Licenses
4. Computer nodes - 10 Nos

	COMPREHENSION I	L	T	P	C
BMT5C1	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to fifth semester				
	Course Designed by – Dept. of Mechatronics				

OBJECTIVES

- To provide a complete review of Mechatronics topics covered up to fifth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to fifth semester.

BMT601	**SENSORS &SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Instrumentation and Control				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the various Sensors involved in the industry.To introduce sensors input and output signals processing.To introduce the current trends in the various types of sensors and it'sprocessing.

COURSE OUTCOMES (COs)

CO1	To learn general concept of sensors and its type
CO2	To understand the different types ofElectrical sensors
CO3	To learn the different types of smart sensors
CO4	To learn the various types of signal conditioning
CO5	To understand the concept of data Acquisition
CO6	To understand the concept of current trends in the various types of sensors and it'sprocessing.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H						L	
	CO2	M			M	H		M					
	CO3				M	H			H				M
	CO4	M			M	H		H	M				
	CO5				M	H							M
	CO6			M	M	H						L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION ANDMECHANICAL SENSORS 10

Sensors and transducers - Classification of sensors- Static and Dynamic characteristics of sensors
Temperature: Filled thermometer – Bimetallic thermometer – monometers.
Elastic transducers– bourdon gauge – bellows – diaphragm.
Vacuum: McLeod gauge, thermal conductivity gauge –Ionization gauge.
Flow measurement: orifice, venture, nozzle, pilot tube, turbine flow meter, hot wire anemometer.

UNIT II ELECTRICAL SENSORS 9

Resistive transducers – Potentiometer– RTD – Thermistor – Thermocouple – Strain gauges – use in displacement, temperature, force measurement – Inductive transducer – LVDT – RVDT – use in displacement – Capacitive transducer – Piezo electric transducer – Digital displacement transducers.

UNIT III SMART SENSORS 9

Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.

UNIT IV SIGNAL CONDITIONING 9

Amplification, Filtering – Level conversion – Linearisation - Buffering – Sample and Hold circuit – Quantization – Multiplexer / Demultiplexer – Analog to Digital converter – Digital to Analog converter.

UNIT V DATA ACQUISITION 8

Data Acquisition conversion-General configuration-single channel & multichannel data acquisition – Digital filtering – Data Logging – Data conversion – Introduction To Digital Transmission system.

TEXTBOOKS:

1. Patranabis. D, "Sensors and Transducers", 2nd edition PHI, New Delhi, 2003.
2. David G. Alciatore and Michael B.Histand, "Introduction to Mechatronics and Measurement systems", 3rd edition Tata McGraw-Hill, 2007.

REFERENCES

1. Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999.
2. Ernest O.Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2004.
3. Murthy DVS, "Transducers and Instrumentation", 2nd Edition, PHI, New Delhi – 2008.
4. C.S. Rangan, G.R. Sarma, VSV.Mani, "Instrumentation Devices and Systems", 2nd edition, Tata McGraw-Hill Publishing company Ltd, 2002.

	APPLIED HYDRAULICS AND PNEUMATICS	L	T	P	C
BMT602	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Theory of Machines				

	Course Designed by – Dept of Mechatronics

OBJECTIVES

To learn about the basic concepts of fluid power systems and various application and its circuits

COURSE OUTCOMES (COs)

CO1	To introduce fundamentals of fluid power systems.
CO2	To learn various types and function of hydraulic components.
CO3	To design hydraulic circuits for simple practical applications.
CO4	To learn various types and function of pneumatic components.
CO5	To design pneumatic circuits for simple practical applications.
CO6	To Understand the concept of fluid power systems and the components of pneumatic and hydraulics of the system.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H							
	CO2	M			M	H							
	CO3				M	H		H		L			
	CO4				M	H		H					
	CO5				M	H		H					
	CO6			M		H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction: Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols.Basics of hydraulics – Applications of Pascal's Law-Laminar and turbulent flow – Reynolds's number-Darcy's equation – Losses in pipe, valves and fittings.

UNIT II HYDRAULIC SYSTEM AND COMPONENTS 9

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps.

Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rodless, Telescopic. Cushioning mechanism, Construction of double acting cylinder, Rotary actuators. Fluid motors, Gear, Vane and Piston motors.

UNIT III DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components: Directional control valve – 3/2 way valve – 4/2, 4/3 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram.

Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit

UNIT IV PNEUMATIC SYSTEMS & COMPONENTS 9

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, and Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves.Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and trouble shooting.

TEXTBOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Prentice Hall, 2006.

REFERENCES

1. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
2. Harry L. Stevart D.B, "Practical guide to fluid power, "Taraoeala sons and Port Ltd. Broadey, 1976.
3.Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw-Hill, 1995

BMT604	MICRO CONTROLLER &PLC	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Microprocessor & its Applications				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the Architecture of 8051 and addressing modes. To get the knowledge about 8051 micro controller design, testing design and the applications of the PLC.

COURSE OUTCOMES (COs)

CO1	To learn the Architecture of 8051 microcontroller.
CO2	To understand the 8051 micro controller design and testing design.
CO3	To learn the 8051 micro controller applications.
CO4	To learn the programmable logic controllers.
CO5	To learn the applications of the PLC.
CO6	To Understand the working of micro controller and PLC system from the block diagram.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				L	H							H
	CO2	M			M	H							
	CO3				L	H		M					H
	CO4				L	H		M					
	CO5				M	H							
	CO6				L	L		M					
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
										√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO MICROCONTROLLER 12

8051 Architecture: Microcontroller Hardware – I/O Pins, Ports – External memory – Counters and Timers – Serial data I/O – Interrupts –Instruction set of 8051-Addressing modes- Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions, interrupts.

UNIT II 8051 MICROCONTROLLER DESIGN 12

8051 Microcontroller Design: 8051 Microcontroller Specification 8051 – Microcontroller System Design – Testing the Design, Timing Subroutines, Look up Tables – Serial Data Transmission.

UNIT III INTERFACING AND APPLICATIONS 12 Stepper motor control-Keyboard interfacing-Alpha-Numeric display interfacing Devices –Analog to digital converter interfacing-Digital to analog converter interfacing- Interfacing of Electronic weighing bridge.

UNIT IV INTRODUCTION TO PLC 12 Programmable Logic Controllers: Introduction – Parts of PLC – Principles of operation – PLC sizes – PLC hardware components — PLC programming Simple instructions – Connecting PLC to computer interlocks and alarms -Latching relays PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram.

UNIT V APPLICATIONS OF PLC 12

Timer instructions ON DELAY, OFF DELAY and RETENTIVE Timers, UP COUNTER, DOWN COUNTER and UP DOWN COUNTERS, control instructions – Data manipulating instructions, match instructions; Applications of PLC –case study of Tank level control system - Automatic lubrication of supplier Conveyor belt - Automatic control of warehouse door.

TEXTBOOKS:

1. Kennath J. Ayala.The 8051 Microcontroller Architecture, Programming and Applications, Penram International Publishing (India), 3rd Edition, Mumbai.

2. Microcontroller-Internals, Instructions, Programming & Interfacing by Subrata Ghoshal, Pearson.

3. David Calcutt, Frederick Cowan, and Hassan Parchizadeh," 8051 Microcontroller: An ApplicationsBased Introduction ".

4. FrankD.Petruzella."Programmable Logic Controllers", McGraw–HillBook, 1989.3rd Ed

REFERENCES

1. B.P. Singh, Microprocessors and Microcontrollers, Galcotia Publications (P) Ltd, 2nd Edition, New Delhi, 1997.

2. Embedded Controller Hand book, Intel Corporation, USA.

3. Microcontroller Hand Book, INTEL, 1984.

BSS601	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Chalenges

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I : PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II : SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III: MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'S RESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study.Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V: ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXTBOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

REFERENCE:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004 (Units IV-V)

BMT6L1	**SENSORS AND SIGNAL PROCESSING LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Instrumentation and Control Lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the concept of various sensors and its signal processing using its circuits

COURSE OUTCOMES (COs)

CO1	To learn the concept wave shaping circuit and A/D converter.
CO2	To understand the practical experiments about speed sensor and proximity sensor.
CO3	To learn the practical experiments about V/F and F/V converter.
CO4	To learn the practical experiments about temperature sensors.
CO5	To learn the practical experiments about displacement sensors.
CO6	To Understand the concept of wave shaping circuit and speed sensor by the practical experiments.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H							M
	CO2	M				H		M			L		
	CO3					H		M					M
	CO4					H		M					
	CO5					H		M			L		
	CO6			M									

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Wave Shaping circuit
2. Analog to Digital Converters
3. Digital Comparator
4. Speed measurement using Inductive pickup / Proximity sensor
5. Voltage to frequency converter
6. Frequency to Voltage Converter
7. Measurement of temperature using thermocouple, thermistor and RTD
8. Measurement of displacement using LVDT & Capacitive transducer
9. Position and velocity measurement using encoders
10. Position measurement using linear scales
11. Absolute encoders

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Equipment	Qty
1	Cathode Ray Oscilloscope	5
2	Function Generator	5
3	Regulated power supply	7
4	Displacement Measurement Trainer using LVDT	1
5	Capacitive pickup trainer module (dielectric)	1
6	Position and Velocity measurement using encoder kit	1
7	Position measurement using linear scales kit	1
8	Speed Measurement uses inductive pickup /Proximity sensor kit	1
9	Speed measurement and closed loop control of DC Motor using photo electric pickup kit	1
10	RTD module	1
11	Thermistor module	1
12	Thermocouple module	1
13	Absolute encoder	1
14	PC based data acquisition unit (optional)	1

	MICRO CONTROLLER &PLC LAB	L	T	P	C
BEC6L6	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Micro Processor Lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the programming concepts in 8051 Microcontroller and interfacing of Electronics Devices

COURSE OUTCOMES (COs)

CO1	To learn the basic programming of 8051 microcontroller.
CO2	To understand the 8051 micro controller interface Programming Exercises.
CO3	To learn the 8051 micro controller applications.

CO4	To learn the ladder programming in PLC
CO5	To learn the Sequential operation pneumatic cylinders
CO6	To Understand the concept of 8051 microcontroller and programmable logic controllers by the practical experiments.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H							M
	CO2	M			M	H		M			L		
	CO3				M	H			H				M
	CO4				M	H		M					
	CO5				M	H					L		
	CO6			M	M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. Study of Microcontroller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C. motor controller interface.
5. Study of interrupt structure of 8051.
6. Interfacing high power devices to microcomputer port lines, LED relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydraulic rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Equipments	Qty
1	Regulated power supply	7
2	Pulse generator	1
3	Function generator	5
4	Cathode ray osilloscope	5
5	8051 MicroController Kit	5
6	stepper Motor	2
7	stepper motor interfacing board	2

8	PLC trainer kit and related software	2
9	Hudraulic cylinder	1
10	Pneumatic cylinder	1
11	LED/LCD interface units	1
12	SCR/Triac/Power MOSFET interface unit	1

BMT6L2	**HYDRAULICS &PNEUMATICS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – **HYDRAULICS &PNEUMATICS**				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce design and testing hydraulic and pneumatic circuits. To learn the various control valves like flow, pressure, direction. To practice the simulation using given software.

COURSE OUTCOMES (COs)

CO1	To design and test the hydraulic circuits using various valves.
CO2	To design and test the pneumatics circuits using various valves.
CO3	To model and analysis of fluid power system using MATLAB/LABVIEW.
CO4	To simulate basic electric, hydraulic and pneumatic circuits.
CO5	To learn the practical experiments about pneumatics circuits.
CO6	To Understand the concept of hydraulic circuits and pneumatic circuits by the practical experiments.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H							
	CO2	M			M	H							M
	CO3				M	H							
	CO4				M	H							M
	CO5				M	H							
	CO6			M									

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. **Design and testing of hydraulic circuits such as**
   - **i)** Pressure control

ii) Flow control
iii) Direction control
iv) Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

2. **Design and testing of pneumatic circuits such as**
   i) Pressure control
   ii) Flow control
   iii) Direction control
   iv) Circuits with logic controls
   v) Circuits with timers
   vi) Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.
3. Modeling and analysis of basic electrical, hydraulic, and pneumaticsystems using**MATLAB/LABVIEW** software.
4. Simulation of basic hydraulic, pneumatic and electrical circuits using Automationstudio software.

LIST OF EQUIPMENT(for a Batch of 30 students)

S.No	Equipments	Qty
	Hydraulic Equipments	
1	Pressure relief valve	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotary actuator	1
8	Double solenoid actuated DCV	2
	Single solenoid actuated DCV	1
9	Hydraulic power pack with 2 pumps & 2 pressure relief valve	1
10	PLC	1

S.NO	Pneumatics Equipment	Qty
1	Pneumatic trainer kit with FRL Unit, Single acting cylinder, push buttons.	1
2	Pneumatic trainer kit with FRL unit, Double acting cylinder, manually actuated DCV.	1
3	Pneumatic training kit with FRL unit, Double acting cylinder, pilot actuated DCV.	1
4	Pneumatic trainer kit with FRL unit, Double acting cylinder, Double solenoid actuated DCV, DCV with sensors/ magnetic reed switches.	1
5	PLC with Interface card	1
6	LABVIEW Software& Automation studio software	

Pneumatics Equipment
LABVIEW Software& Automation studio software.

BMT702	**SIMULATION &MODELING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Mathematics-II,Control System				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the concepts and current trends in Simulation and Modeling and to acquaint the student with various technique used in simulation of Mechatronics system.

COURSE OUTCOMES (COs)

CO1	To learn the basic concepts of system and simulation
CO2	To understand the various methods of generating and testing random numbers
CO3	To learn the various methods of random Variate generation
CO4	To learn the concept about analysis of simulation data
CO5	To learn the various software for simulation and modeling
CO6	To develop simulation models for various systems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M			M	H							
	CO2	M	W		L	H							
	CO3	M	W		M	H							
	CO4					H							
	CO5				H	H							
	CO6			H									

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SYSTEM AND SYSTEM ENVIRONMENT 9

Component of a System – Continuous and discrete systems – Types of model; Steps in Simulation study; Simulation of an event occurrence using random number table – Single server queue –two server queue – inventory system.

UNIT II RANDOM NUMBER GENERATION 9

Properties of random numbers – Generation of Pseudo – random numbers – techniques of generating pseudo random numbers; Test for random numbers: the Chisquare test-the kolmogrov Smirnov test – Runs test – Gap test – poker test.

UNIT III RANDOM – VARIATE GENERATION 9

Inverse transform technique for Exponential, Uniform, triangular, weibull, empirical, uniform and discrete distribution, Acceptance rejection method for Poisson and gamma distribution; Direct Transformation for normal distribution.

UNIT IV DATA ANALYSIS 9

Analysis of simulated Data – Data collection, identifying the distribution, Parameter estimation, goodness of fit tests, verification and validation of simulation models.

UNIT V SIMULATION CASE STUDIES 9

Comparison and selection of GPSS, SIMSCRIPT, SLAM Arena simulation languages: Development of simulation models using Arena simulation package for queuing system, Production system, inventory system, maintenance system.

TEXT BOOKS:

1. Banks J., Carson J.S. and Nelson B.L., "Discrete – Event System Simulation", 5th Edition, Pearson Education, Inc 2006 (ISBN 81-7808-505-4).

REFERENCES:

1. Geoffrey Gorden, "System Simulation", Prentice Hall of India, 2003.
2. Narsingh Deo., "System Simulation with Digital Computer", Prentice Hall of India, 2003.

Web REFERENCES

1. www.arenasimulation.com
2. www.gpss.co.uk
3. www.caciasl.com
4. Other useful sites can be found in the text book recommended for this course.

BMT701	**ROBOTICS &MACHINE VISION SYSTEM**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Electrical Machines and Drives ,Applied Hydraulics and Pneumatics, Sensors and signal Processing				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the basic concepts and components of robotics .To learn the machine vision concepts based on Image Processing Techniques

COURSE OUTCOMES (COs)

CO1	To introduce the automation, robotics and its components
CO2	To explain the various methods of forward kinematics and reverse kinematics

CO3	To explain the various end effectors and sensors used in robot
CO4	To explain the machine vision technique
CO5	To explain the image processing technique and application of MV
CO6	To learn about the various applications of Vision System

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H							
	CO2	M			M	H							
	CO3				M	H							
	CO4				M	H							
	CO5				M	H							
	CO6			M	M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I ROBOTICS INTRODUCTION 9

Robotics – Introduction–Basic Structure– Classification of robot and Robotic systems –laws of robotics – robot motions – work space, precision of movement.

Drives and control systems: Hydraulic systems, power supply – servo valve – sump – hydraulic motor – DC servo motors – stepper motors – operation.

Mechanical Components of Robots: Power transmission systems: Gear transmission. Belt drives, cables, Roller Chains, Link – Road Systems, Rotary to linear motion conversion, Rack and pinion drives, ball bearing screws, speed reducers, Harmonic drives.

UNIT II KINEMATICS OF ROBOT 10

Introduction, Matrix Representation, Homogeneous transformation, forward and inverse Kinematics, Inverse Kinematics Programming, Degeneracy, dexterity, velocity and static forces, velocity transformation force control systems, Basics of Trajectory planning.

UNIT III ROBOT END EFFECTORS 8

Types of end effectors – Mechanical grippers – Types of Gripper mechanisms – Grippers force analysis – Other types of Grippers – Vacuum cups – Magnetic Grippers – Adhesive Grippers – Robot end effector interface.

Sensors: Position sensors – Potentiometers, encoders – LVDT, Velocity sensors, Acceleration Sensors, Force, Pressure and Torque sensors, Touch and Tactile sensors, Proximity, Range and sniff sensors, RCC, VOICE recognition and synthesizers.

UNIT IV MACHINE VISION 9

Introduction – Image processing Vs image analysis, image Acquisition, digital Images – Sampling and Quantization – Image definition, levels of Computation.

Image processing Techniques: Data reduction – Windowing, digital conversion. Segmentation – Thresholding, Connectivity, Noise Reduction, Edge detection, Segmentation, Region growing and Region Splitting, Binary Morphology and grey morphology operations.

UNIT V FEATURE EXTRACTION 9

Geometry of curves – Curve approximation, Texture and texture analysis, Image resolution – Depth and volume, Color processing, Object recognition by features, Depth measurement, specialized lighting techniques. Segmentation using motion – Tracking. Image Data Compression, Real time Image processing, Application of Vision systems.

TEXT BOOK:

1. M.P. Groover, Industrial Robotics – Technology, Programming and Applications, McGraw-Hill, USA, 2008. 2nd Edition.

REFERENCES :

1. Saeed B. Niku, Introduction to Robotics: Analysis, Systems, Applications, 2nd edition, Pearson Education India, PHI 2003 (ISBN 81-7808-677-8)
2. Ramesh Jam, Rangachari Kasturi, Brain G. Schunck, Machine Vision, Tata McGraw-Hill, 1991. 1st Edition.
3. Yoremkoren, Robotics for Engineers, McGraw-Hill, USA, 1987.
4. P.A. Janaki Raman, Robotics and Image Processing, Tata McGraw-Hill, 1991.

BAM705	**AUTOMOTIVE ELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Sensors and Signal Processing				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the evolution of electronics in automobile and the various sensors and ECUs used in vehicle

COURSE OUTCOMES (COs)

CO1	To understand the working of charging and starting systems
CO2	To study about the engine basics and various types of ignition systems
CO3	To gain knowledge on different types of injection systems
CO4	To know the characteristics of various sensors and actuators.
CO5	To understand the concept of engine management system and CAN standard
CO6	To learn the safety system in automotive electronics

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H							
	CO2				M	H				L			
	CO3				M	H		M					
	CO4				M	H							
	CO5				M	H							
	CO6			M	M	H				L			
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION 8

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Charging systems – working and design of charging circuit diagram – starter motors and starter circuits.

UNIT II BASICS OF ENGINES 10

Operating principles of IC engine – major engine components – engine cylinder arrangements – the ignition systems – Electronic ignition, direct ignition, injection systems – working of the carburetor – throttle body injection – Multipoint fuel injection – sequential fuel injection.

UNIT III SENSOR AND ACTUATORS 7

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS 10

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system – In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS 10

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TEXT BOOK :

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000. 4th Edition.

REFERENCES :

1. William B. Ribbens, "Understanding Automotive Electronics", 7th edition, Newnes Publishing, 2000.
2. Barry Hollembeak, "Automotive Electricity, Electronics & Computer Controls", Delmar Publishers, 2001.
3. "Fuel System and Emission controls", Check Chart Publication, 2000.
4. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999. 2nd edition.

BME7L3	**CAD/CAM LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – CNC Lab, Finite element Analysis, Computer Aided Machine Drawing				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

To impart knowledge about various software tools in CAD to design and model different products

COURSE OUTCOMES (COs)

CO1	To learn to design components like screw jack using Pro E
CO2	To learn to design components like Knuckle joint using Creo software
CO3	To learn to design products using Pro E &CATIA
CO4	To learn to analyze engineering problems using FEA package
CO5	To study about operations like drilling, boring in lathe using Precut software
CO6	To study about operations like milling in lathe using Precut software

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	M	H							
	CO2			H	L	H							
	CO3			H	M	H							
	CO4				M	H							
	CO5					H							
	CO6				L	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Solid modeling using Ideas / Pro Engineering / CATIA software of gives components / products such as (at least 3 components)
2. Analysis of engineering problems using FEA package (at least 3 problems)
3. Exercise in surface machining – Multi Axis Machining and software Development for manufacturing. (at least 3 jobs)
4. Computer assisted part programming using Master Computer Software for various internal and external curved surface machining.

LIST OF EQUIPMENT (for a batch of 30 students)

1. Any CAD software – 10 licenses
2. Any FEA software – 5 licenses
3. Any CAM software – 10 licenses

BMT7L3	**ROBOTICS LAB**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									0	0	3	2
	Prerequisite – Sensors and Signal Processing Lab, Microcontroller Lab												
	Course Designed by – Dept of Mechatronics												
OBJECTIVES: To impart knowledge on building robots and practice exercises on Robot.													
COURSE OUTCOMES (COs)													
CO1	To understand different types of robots based on configuration and application												
CO2	To study of different type of links and joints used in robots												
CO3	To study about various end effectors used in robots												
CO4	To learn about the different types of drive system												
CO5	Verification of transformation (Position and orientation) with respect to gripper and world coordinate system												
CO6	To practices on programming exercises on Robot												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	M	H							
	CO2			H	M	H							
	CO3			H	M	H							
	CO4			H	M	H							
	CO5			H	M	H							
	CO6			H	M	H							
3	Category	Humanities & Social Studies		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper Seminar/ Internship (PR)	
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EXPERIMENTS

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
6. Estimation of accuracy, repeatability and resolution.
7. Robot programming exercises

(Point-to-point and continuous path programming)

LIST OF EQUIPMENT (for a batch of 30 students)

S.No	Name of the Equipment/components	No. of Items
1	Any one type of robot configuration with at least five degree of freedom.	1 set
2	Robot programming software inclusive of computer system.	10 licenses
3	Models of different types of end effectors drive systems Links and Joints.	5 each
4	Models of different configuration robots	5 each

	TERM PAPER	L	T	P	C
BMT7P1	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Professional Courses				
	Course Designed by – Dept. of Mechatronics.				

OBJECTIVES

- Learn to work as a member of a project team.
- Understand project management tasks.
- Develop a hardware / software solution for a real-time, industry relevant problem.

COURSE OUTCOMES (COs)

CO1	Apply knowledge of basic science and engineering to Mechatronics problems
CO2	Implement the simple applications and verify using modern simulation tools.
CO3	Identify, formulate, and model engineering equipment
CO4	Recognize the real world applications and to solve with core engineering knowledge.
CO5	Analyze and work on multidisciplinary tasks
CO6	Choose latest tools, software and equipment to solve real world problems

	COMPREHENSION II	L	T	P	C
BMT8C1	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses upto eighth semester				
	Course Designed by – Dept. of Mechatronics				

OBJECTIVES

- To provide a complete review of Electrical &Electronics engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

	PROJECT WORK	L	T	P	C
BMT8P1	Total Contact Hours - 45	0	0	18	9
	Prerequisite –Term paper				
	Course Designed by – Dept. of Mechatronics.				

OBJECTIVES

- Learn to work as a member of a project team.
- Understand project management tasks.
- Develop a hardware / software solution for a real-time, industry relevant problem.

COURSE OUTCOMES (COs)

CO1	Apply knowledge of basic science and engineering to Mechatronics problems
CO2	Implement the simple applications and verify using modern simulation tools.
CO3	Identify, formulate, and model engineering equipment
CO4	Recognize the real world applications and to solve with core engineering knowledge.
CO5	Analyze and work on multidisciplinary tasks
CO6	Choose latest tools, software and equipment to solve real world problems

CORE ELECTIVE – I

	INTEGRATED CIRCUITS	L	T	P	C
BMT001	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Basic Electronic Engineering, Power Electronics.				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the concept of Integrated Circuits and Various new technology in Integrated Circuits. To acquaint the student with various concepts used in integrated circuits.

COURSE OUTCOMES (COs)

CO1	To learn the characteristics of op-amp & its fundamentals.
CO2	To understand the various application of op-amp.
CO3	To learn the various types of digital to analog and analog to digital converters.
CO4	To learn the concept of Special IC's and Voltage regulator.
CO5	To learn the concept of phase logged loop and function generator.
CO6	To Study Analog Multiplier and PLL.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L			H							
	CO2	H	L			H		L					
	CO3	H	L			H							
	CO4	H	L			H							
	CO5	H	L			H							
	CO6	H	L			H							
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I CHARACTERISTICS OF OPAMP & ITS FUNDAMENTALS9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of opamp - summer, differentiator and integrator, V/I &I/V converter.

UNIT IIAPPLICATIONS OF OPAMP 9

Sign Changer, Scale Changer, Phase Shift Circuits, Logarithmic amplifier, Precision rectifier, Instrumentation amplifier, Comparators, multivibrators, Schmitt trigger, waveform generators, clippers, clampers, peak detector, S/H circuit, First and Second order active filters, Low-pass, high-pass and band-pass Butterworth filters

UNIT III ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9

Analog and Digital Data Conversions, D/A converter – specifications – weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications – Flash type – Successive Approximation type – Single Slope type – Dual Slope type – A/D Converter using Voltage-to- Time Conversion – Over-sampling A/D Converters.

UNIT IV SPECIAL ICs & VOLTAGE REGULATORS 9

555 Timer circuit - Functional block, characteristics & applications; 566-voltage controlled oscillator circuit, OP-Amp Voltage regulator-Series, Shunt and switching regulator.

UNIT V ANALOG MULTIPLIER AND PLL 9

Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

TEXT BOOKS

1. Ramakant AGayakward, "Op-amps and Linear Integrated Circuits", IV Edition, Pearson Education/ PHI 2003.
2. Roy Choudhary.D, Sheil BJani, "Linear Integrated Circuits", II edition, New Age, 2003.
3. Morris Mano.M, "Digital Logic and Computer Design" Published byDelhi Pearson,2009.
4. Robert FCoughlin, Fredrick F.Driscoll, "Op-amp and Linear ICs", Pearson Education, 4th edition, / PHI 2002.
5. https://zawequbipy.files.wordpress.com

REFERENCES

1. David A.Bell, "Op-amp & Linear ICs", Prentice Hall of India, 4th edition,2002.
2. Charles H.Roth, "Fundamentals Logic Design", Jaico Publishing, 6th edition, 2006.
3. Floyd, "Digital Fundamentals", 10th edition, Pearson Education, 2008.

BMT002	**VIRTUAL INSTRUMENTATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamentals of computing and programming, Design of Mechatronics System.				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the Virtual Instrument. To study of LABVIEW software andabout image processing

COURSE OUTCOMES (COs)

CO1	To introduce the virtual instrumentation
CO2	To learn about LABVIEW
CO3	To learn array operation
CO4	To learn basic DAQ hardware and software
CO5	To learn image acquisition
CO6	To learn Computer based instruments, Image acquisition and Motion Control.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H							H	H	
	CO3		M		H								
	CO4					M	H					H	
	CO5							H	H			H	
	CO6		M	H			M	H	H		H	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO VIRTUAL INSTRUMENTS 9

Historical perspective and traditional bench-top instruments - General functional description of a digital instrument- Block diagram of a Virtual Instrument – Physical quantities and analog interfaces- Hardware and Software – User Interfaces –Advantages of Virtual Instruments over conventional instruments – Architecture of a Virtual Instruments and its relation to the operating system.

UNIT II LABVIEW GRAPHICAL PROGRAMMING 9

LabVIEW – graphical user interfaces- controls and Indicators – 'G' programming –data types – data flow programming –Editing Debugging and Running a Virtual Instrument –Graphical programming palettes and tools – Front panel objects – Function and Libraries.

UNIT III LABVIEW BASIC PROGRAMMING 9

FOR Loops, WHILE loops, Shift Registers, CASE structure, formula nodes-Sequence structures-Arrays and Clusters- Array operations – Bundle, Unbundle – Bundle/Unbundle by name, graphs and charts – string and file I/O – High level and Low level file I/Os – attribute nodes local and global variables.

UNIT IV BASICS OF DAQ 9

Basics of DAQ Hardware and Software – Concepts of Data Acquisition and terminology – Installing Hardware, Installing drivers -Configuring the Hardware – addressing the hardware in LabVIEW- Digital and Analog I/O function – Buffered I/O – Real time Data Acquisition.

UNIT V VI COMMUNICATION 9

Simple programs in VI- Advanced concepts in LabVIEW- TCP/IP VI's, Synchronization – other elements of Virtual Instrumentation – Bus extensions – PXI - Computer based instruments - Image acquisition –Motion Control.

TEXT BOOKS :

1. Garry M. Johnson "Lab VIEW Graphical Programming", Tata McGraw-Hill, 5th Edition, 2009
2. Lisa.K.Wills, "LabVIEW for Everyone" Prentice Hall of India, 2009.

REFERENCES :

1. Labview Basics I and II Manual, National Instruments, 2009
2. Barry Paton, "Sensor, Transducers and Lab VIEW", Prentice Hall, 2007.

BME001	INDUSTRIAL ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Basic Mechanical Engineering, Manufacturing Technology.				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the production and industrial process.To study of various industrial engineering process and productivity

COURSE OUTCOMES (COs)

CO1	To learn about Production and Productivity
CO2	To learn about plant layout
CO3	To learn about work-study
CO4	To understand the concept of industrial psychology
CO5	To learn about statistical quality control
CO6	To Study Tolerance Percent Defective and Average Outgoing Quality

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H		H	M						
	CO2			H		H					H	H	
	CO3				H								
	CO4					M	H					H	
	CO5					M					L	H	H
	CO6			H			H					H	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PRODUCTION AND PRODUCTIVITY 9

Definitions-Productivity, Effectiveness, and Types-Factors Influencing Productivity-Techniques To Improve Productivity, Technology Based Techniques and material Based Productivity Improvement-Inventory Control-M.R.P-Quality Circles-Brainstorming-Pareto Analysis-Cause And Effect Analysis-TQM-Zero Defects-Flextime-Just In Time-Ergonomics-Reliability Improvement-Modular Design-Maintainability**.**

UNIT II PLANT LAYOUT /LOADING AND SCHEDULING 9

Types of Layout, Its Advantages and Disadvantages-Preference of Different Types of Layout, Plant Location and Decision-Definitions: Group Technology-Principles of Material Handling. Loading Master Scheduling- Perpetual Loading-Order Scheduling-Loading By Scheduled Method-Index Method Of Scheduling-Factors Influencing Scheduling-Production Planning And Control-Routing And Dispatching-Job Card-Job Order-Order Control And Machine Load Chart.

UNIT III WORKSTUDY 9

Techniques of Work Study-Procedure-Method Study,Types of Process Charts and Diagrams-Multiple Activity Chart-Utility-Time Study-Micro Motion Time Study-PMTS-Work Sampling-Job Analysis-Job Evaluation and Merit Rating-Wage and Wage Incentive.

UNIT IV INDUSTRIAL PSYCHOLOGY 9

Introduction-Nature And Scope-Objectives-Hawthorne Studies And Its Conclusion-Individual Behaviour-Group Behaviour,Types Of Groups-Formal And Informal Organizations-Fatigue – Accident,Major Factors,Prevention-Importance And Methods Of Training To The Employees, Methods And Aids-Leadership And Leadership Styles-Communication And Its Importance.

UNIT V STATISTICAL QUALITY CONTROL 9

Introduction to Quality Control-Statistical Measures-Control Chart-Types –Control Chart for Attributes-Control Chart for Number of Defects per Unit-Acceptance Sampling-Basic Probability-Normal Distribution-Acceptable Quality Level-Lot Tolerance Percent Defective-Average Outgoing Quality

TEXTBOOKS:

1. Khanna.O.P. Industrial Engineering and Management, Khanna Publishers, New Delhi, 2012.
2. B.Kumar, Industrial Engineering, Hanna Publishers,2014

REFERENCES

1. Gupta And Petal, Work Study- Khanna Publishers, 2011.

CORE ELECTIVE – II

BMT003	**COMPUTER INTEGRATED MANUFACTURING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – CNC Technology, Manufacturing Technology				
	Course Designed by – Dept ofMechatronics				

OBJECTIVES

To understand the various concepts of CAD,CAM and Computer Integrated Manufacturing

COURSE OUTCOMES (COs)

CO1	To introduce the CAD and its element.
CO2	To explain the elements of cad systems and design using computers.
CO3	To explain the various component design using computer.
CO4	To explain the computer aided manufacturing.
CO5	To explain the computer integrated manufacturing.

CO6	To Understand the concept of CAD systems and computer aided manufacturing from Detailed Design and Documentation and Group Technology.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H		M					
	CO2	M			M	H							
	CO3				M				H				
	CO4					H					L		M
	CO5				M	H							
	CO6			M									
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)				
						√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO CAD AND ITS ELEMENTS 9

Principles of Computer hardware, Software and Operating System, application Programs, Data Handling and File Structures, Computer aid in Phases of design- Development of Design Database using CAD Systems- Conceptual Design Process Analysis Optimization- Detailed Design and Documentation.

UNIT II ELEMENTS OF CAD SYSTEMS AND DESIGN USING COMPUTERS9

Elements of CAD Systems, Introduction to Graphic Hardware, Software, Details of 2D Software Packages-Layering, Drawing Primitives, Display Techniques, Editing, utilities, Scaling, Dimensioning, 3D Visualization,Geometric Modeling-Wireframe and Solid models.

UNIT III DESIGN USING COMPUTERS 9

Design of Gears, Couplings, Flywheels, Shafts Connecting Rods etc.Software for Vibration Problems Stress Analysis, Kinematic Analysis, Dynamic Analysis.

UNIT IV COMPUTER AIDED MANUFACTURING9

Numerical Control- Modes- NC Elements- NC Machine Tools- CNC Machines- CNC Hardware Basics- CNC Tooling- CNC Machine Tools and Control System- Part Programming- Manual and Computer Aided- Turning Center Programming- Advanced Part Programming- Direct Numerical Control- Adaptive Control- Computer Aided Part Programming, APT, Introduction to Robotics, Group Technology, Computer Aided Process Planning, FMS.

UNIT V COMPUTER INTEGRATED MANUFACTURING 9

CIM as a Concept and a Technology- CASA/SME Model of CIM-Benefits- Communication Matrix in CIM- Fundamentals of Computer Communication n CIM, CIM Data Transmission Method, Serial , parallel, asynchronous, modulation, Demodulation, Simplex and Duplex- Types of Communications in CIM- Point to Point, Star and Multiplexing- CIM for Batch Production-

Group Technology – FMS- Process Control in CIM- Characteristics of Manufacturing Process Data- Continuous, Analog, Discrete Binary and Pulse Data- ADC/DC Multiplexers, Process Monitoring Through Computer- Types of Computer Process Control- Preplanned, Direct Digital Control (DDC)- Regular Control and Feed Forward Control, Requirements of Control Programming Interrupt, Real Time Clock Input.

TEXT BOOK:

1. Radhakrishnan P. CAD/CAM/CIM, 3rd Edition, New central Book Agency, 2008.

REFERENCES

1. Rao P.N. CAD/CAM, Principles and Application, Tata McGraw Hill, 2005.2nd Edition.
2. Mikell P.Groover, Automation, Production Systems and CIM, 4th Edition, Prentice Hall of India,2001.
3. Chris McMahon and Jimmy Browne, CAD/CAM, Pearson Education, 2001.2nd Edition.

BMT004	**NEURAL NETWORK & FUZZY LOGIC SYSTEMS**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									3	0	0	3
	Prerequisite – Maths & fundamentals of Computing												
	Course Designed by – Dept of Computer Science & Engineering												
OBJECTIVES: To introduce the neural network, associative memories and fuzzy logic system.													
COURSE OUTCOMES (COs):The Course outcomes of Thermodynamics and Heat transfer													
CO1	To learn basics of neural networks.												
CO2	To learn about feed forward neural network.												
CO3	To learn about associative memories												
CO4	To learn about classical and fuzzy sets.												
CO5	To learn about application of neural networks and fuzzy logic.												
CO6	To know about real time applications												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H							H	H	
	CO3		M		H								
	CO4					M	H					H	
	CO5							H	H			H	
	CO6								M		H		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	

						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN. Essentials of Artificial Neural Networks. Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Learning Strategy . (Supervised, Unsupervised, Reinforcement), Learning Rules.

UNIT II FEED FORWARD NEURAL NETWORKS: 9

Single Layer Feed Forward Neural Networks- Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model. Multilayer Feed forward Neural Networks- Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT III ASSOCIATIVE MEMORIES `9

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM TrainingAlgorithms: Storage and Recall Algorithm, BAM Energy Function. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis.

UNIT IV CLASSICAL & FUZZY SETS 9

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzy Logic System Components. Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

UNIT V APPLICATIONS 9

Neural network applications: Process identification, control, fault diagnosis. Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOKS:

1. S.Rajasekharan and G. A. Vijayalakshmi pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.
2. John Yen and Reza Langan, "Fuzzy Logic: Intelligence, Control and Information", Pearson Education,2004.

REFERENCES:

1. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2001.2nd Edition.
2.S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TMH, 2006.

3. James A Freeman and Davis Skapura, Neural Networks Pearson Education, 2002.
4. Timothy J. Ross, " Fuzzy Logic With Engineering Applications", McGraw-Hill Inc. 1997.3rd Ed.

BMT005	**EMBEDDED SYSTEM AND DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Electron Devices & Circuits ,Power Electronics, Control system				
	Course Designed by – Dept of Electronics and communication Engineering				

OBJECTIVES : To study embedded hardware and embedded microcomputer systems

COURSE OUTCOMES (COs) The Course outcomes of Thermodynamics and Heat transfer

CO1	To learn review of embedded hardware
CO2	To learn about microchip PIC micro controller
CO3	To learn embedded microcomputer systems
CO4	To learn about software development
CO5	To understand the real time operating systems
CO6	To know about embedded system applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H							H	H	
	CO3		M		H								
	CO4					M	H					H	
	CO5							H	H			H	
	CO6								M			H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I REVIEW OF EMBEDDED HARDWARE 9

Gates – Timing diagram – Memory – Microprocessors Buses – Direct Memory Access – Interrupts – Built-in functions on the Microprocessor – Conventions used on Schematic – schematic. Interrupts Microprocessor Architecture – Interrupt basics – Shared data Problem – Interrupt latency.

UNIT II MICROCHIP PIC MICRO CONTROLLER 9

Introduction, CPU Architecture – Registers – Instruction sets addressing modes – Loop timing – Timers – Interrupts, Interrupt timing, I/O Expansion, I^2C Bus Operation Serial EEPROM, Analog to Digital converter, UART – Baud Rate – Data Handling – Initialization, special features- Serial Programming – Parallel Slave Port.

UNIT III EMBEDDED MICROCOMPUTER SYSTEMS 9

Motorola MC68H11 Family Architecture, Registers, Addressing modes Programs, Interfacing methods parallel I/O interface, parallel port interfaces, Memory Interfacing, High Speed I/O Interfacing, Interrupts – Interrupt service routine – Features of interrupts – Interrupt vector and Priority, Timing Generation and Measurements, Input capture, Output compare, frequency Measurement, Serial I/O devices RS 232, RS485.

UNIT IV SOFTWARE DEVELOPMENT 9

Round Robin, Round robin with Interrupts, function – Queue – Scheduling Architecture, Algorithms. Introduction to – Assembler – Compiler – Cross Compilers and Integrated Development Environment (IDE) Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

UNIT V REAL TIME OPERATING SYSTEMS 9

Task and Task States, Tasks and Data, Semaphores and Shared Data Operating System services – Message Queues – Timer function – Events – Memory Management, Interrupt Routines in an RTOS environment, Basic design using RTOS.

TEXT BOOKS :

Jonarthan W. Valvano "Embedded Microcomputer Systems", Real Time Interfacing", Thomson learning, 2001.3rd Edition.

REFERENCES :

1. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, 2001.
2. John B Pitman, "Design with PIC Micro controllers", Pearson Education Asia, 1998.
3. Burns, Alan and Wellings, "Real – Time Systems and Programming Languages", second edition. Harlow: Addison Wesley – Longman, 1997.
4. Grehan Moore and Cyliax, "Real Time Programming: A guide to 32 bit Embedded Development", Addison Wesley – Longman, 1998.
5. Heath Steve, "Embedded Systems Design", Newnes, 1997.2nd Edition.

CORE ELECTIVE – III

BMT007	**MICROELECTRONICS AND NANOELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engineering Physics I & II,Basic Electronics Engineering				
	Course Designed by – Department of Mechatronics				

OBJECTIVES

To introduce the various concepts about the micro electronics and nano electronics

COURSE OUTCOMES (COs)

CO1	To introduce the semiconductor physics and quantum electronics
CO2	To explain the different types of junctions

CO3	To explain the MOS structure
CO4	To introduce and explain the nano electronics and its structure
CO5	To explain the molecular electronics
CO6	To understand the concept of various application of micro electronics & Nano electronics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		M			H							
	CO2				M	H					M		
	CO3				M	H					M		
	CO4				M	H							
	CO5				M	H							
	CO6		L		M	H					L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT-I SEMICONDUCTOR PHYSICS 9

Introduction to semiconductor physics: Review of quantum mechanics, electrons in periodic lattices, E-k diagrams, Quasi-particles in semiconductors, electrons, holes and phonons. Boltzmann transport equation and solution in the presence of low electric and magnetic fields - mobility and diffusivity; carrier statistics; continuity equation, poisson's equation and their solution; high field effects: velocity saturation, hot carriers, avalanche breakdown, punch through and kirk effects.

UNIT-II SEMICONDUCTOR JUNCTIONS 9

Semiconductor junctions: Schottky, homo- and hetero-junction band diagrams and I-V characteristics, small signal switching models; two terminal and surface states devices based on semiconductor junctions. Bipolar transistor working, its charge control, and gummel poon model, structure of graded base, graded emitter transistor, hetro junction transistor.

UNIT-III MOS STRUCTURES 9

MOS structures: Semiconductor surfaces; the ideal and non ideal MOS capacitor band diagrams and CVs; Effects of oxide charges, defects and interface states; characterization of MOS capacitors: HF and LF CVs, avalanche injection; high field effects and breakdown. Long & short channel effects.

NANOELECTRONICS

UNIT-IV MOSFET 9

Shrink-down approaches: Introduction, CMOS scaling, the nanoscale MOSFET, finfets, vertical. MOSFETs, limits to scaling, system integration limits (interconnect issues etc.), resonant tunneling transistors, single electron transistors, new storage, optoelectronic, and spintronics devices.

UNIT-V CARBON NANOTUBE ELECTRONS 9

Atoms-up approaches: Molecular electronics involving single molecules as electronic devices, transport in molecular structures, molecular systems as alternatives to conventional electronics, molecular interconnects; Carbon nanotube electronics, bandstructure & transport, devices, mems applications.

TEXTBOOKS:

1. Millman and Grabel, "Microelectronics", 2nd Ed. Tata McGraw-Hill (2004).
2. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2002

REFERENCE:

1. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York (1997).
2. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 10th Ed., Pearson Education India, New Delhi (2001).
3. Cooper and Helfrick, "Modern Electronic Instrumentation and Measuring Techniques", 4th print Prentice Hall of India, New Delhi (1996).
4. Boylestad and Nashelsky, "Electronic Devices and Circuit Theory", 8th Ed, Pearson Education India, New Delhi (2002).
5. S.M. Kang & Y. Leblibici, "CMOS Digital Integrated Circuits-Analysis & Design", TMH, 3rd Ed. 2003.

6. A.Nabok, "Organic and Inorganic Nanostructures", Artech House, 2000.
7. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: "Nanotechnologies and Nanophysics", Springer-Verlag Berlin Heidelberg, 2007.

BMT008	**MEMS AND NANOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Sensor and Signal Processing, Basic electronics				
	Course Designed by – Department of Mechatronics				

OBJECTIVES

To introduce the various concepts about the micro electronics mechanical system and Nano technology

COURSE OUTCOMES (COs)

CO1	To introduce various micro sensors and emergence of micro machines.
CO2	To study about various materials for micro and Nano fabrication

CO3	To know various micro fabrication methods.
CO4	To understand the concept of Nano scale and technology
CO5	To learn Nano scale manufacturing
CO6	To understand the concepts about various MEMS and nano applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H	L						
	CO2				M	H	L						
	CO3				M	H	L						
	CO4				M	H	L						
	CO5				M	H	L						
	CO6				M	H	L						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO MICRO SENSORS 9

Introduction: Historical background development of microelectronics, evolution of micro sensors, MEMS, emergence of micro machines.

Micro sensors: Introduction, thermal sensors, mechanical sensors, flow sensors and Introduction to SAW devices

UNIT II MEMS MANUFACTURING TECHNIQUES 9

MEMS materials and processing: Overview, metals, semiconductors, ceramic, polymeric and composite materials.

Microstereolithography: Introduction, Scanning Method, Projection Method, Applications. LIGA Process: Introduction, Basic Process and Application.

UNIT III MEMS FABRICATION TECHNIQUES 9

Micro System Fabrication Processes: Photolithography, Chemical Vapor Deposition, Etching, Bulk and Surface Micro Manufacturing

UNIT IV INTRODUCTION TO NANOTECHNOLOGY 9

Introduction to Nanotechnology: The nanoscale. Consequences of the nanoscale for technology and society. - Technologies for the Nanoscale, Top-down versus bottom-up assembly. Visualisation, manipulation and characterisation at the nanoscale, Proximal probe technologies. Self-assembly.

UNIT V NANOSCALE MANUFACTURING 9

Nanoscale Manufacturing: Nanomanipulation, Nanolithography - An introduction to tribology and its industrial applications - Nanoscale Materials and Structure, Nanocomposites, Safety issues with nanoscale powders - Applications, Applications in energy, informatics, medicine, etc

TEXTBOOKS:

1. Mark Ratner & Daniel Ratner, Nano Technology, Pearson Education,2003.
2. Tai – Ran Hsu, " MEMS & MICROSYSTEMS Design and Manufacturing", TATA McGRAW- HILL, 2002
3. S.M. Sze, Semiconductor Sensors, John Wiley & Sons, INC., 1994.

REFERENCE:

1. Marc J. Madou, "Fundamentals of Microfabrication", II Edition, CRC Press, 2002.
2. Mohamed Gad-el-Hak, The MEMS Handbook, CRC Press, 2002
3. M.Elwenspoek, R.Wiegerink, Mechanical Microsensors, Springer-Verlag Berlin Heidelberg, 2001.
4. David Ferry, Transport in Nanostructures, Cambridge University Press, 2000.2nd Edition.
5. S.Datta,Electron Transport in Mesoscopic Systems, Cambridge University Press, 1995.
6. Beenaker and Van Houten, Quantum Transport in Semiconductor Nanostructures, in Solid State Physics v. 44, eds. Ehernreich and Turnbull, Academic Press, 1991.
7. P. Rai-Choudhury, Handbook of Microlithography, Micromachining & Microfabrication, SPIE, 1997

BMT009	**RAPID PROTOTYPING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Integrated Manufacturing				
	Course Designed by – Dept of Mechatronics Engineering				

OBJECTIVES

To study about prototyping principles and tools used for prototyping and to learn about the applications of rapid prototyping

COURSE OUTCOMES (COs)

CO1	To learn the basic concepts of product development
CO2	To learn about the various types of RP systems and their applications
CO3	To study about the different types of RP modeling systems and their applications
CO4	To understand the types of solid curing process and its applications
CO5	To learn about the different types 3-Dimensional Printers and their applications
CO6	To understand various Application of Rapid prototyping in Medical field

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H		H				M	H	H	
	CO3		M		H	H		H					

	CO4	M	H			M	H					H	
	CO5	L						H	H	M		H	
	CO6											H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)	
									√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO RAPID PROTOTYPING 7

Introduction: Need for time compression in product development, Product development-conceptual design – development- detail design-prototype- tooling.

UNIT II RP SYSTEMS CLASSIFICATIONS 9

Classification of RP systems, Stereo lithography systems- Principle- process parameters-process details-machine details, Applications.

Direct Metal Laser Sintering (DMLS) system - Principle process parameters process details-machine details, Applications.

UNIT III RP SYSTEM MANUFACTURING TECHNIQUES 9

Fusion Deposition Modeling - Principle- process parameters-process details-machine details, Applications.Laminated Object Manufacturing - Principle process parameters process details machine details, Applications.

UNIT IV DESIGN 3-DIMENSIONAL PRINTERS 10

Solid Ground Curing - Principle- process parameters-process details-machine details, Applications.3-Dimensional Printers - Principle- process parameters-process details-machine details, Applications, and other Concept Modelers like Thermo jet printers, Sander's model maker, JP system 5, Object Quadra system.

UNIT V APPLICATIONS OF RP SYSTEMS 10

Laser Engineering Net Shaping (LENS), Ballistic Particle Manufacturing (BPM)-Principle. Introduction to rapid tooling and rapid manufacturing, software for RP- STL files, Magics, Mimics Application of Rapid prototyping in Medical field.

TEXTBOOKS:

1. Pham D.T & Dimov.S.S, Rapid manufacturing, Springer-Verlag, London, 2001
2. C. K. Chua ,K.F. Leong , C.S. Lim**,** Rapid Prototyping: Principles and Applications (Book & CD Rom),3rd edition ,16 Dec 2008

REFERENCES

1. Terry Wohlers, Wohlers Report 2000, Wohlers Assosiates, USA, 2000.
2. M. Adithan ,Rapid Prototyping,2015

NON MAJOR ELECTIVE-I

BMT010	DESIGN OF MECHATRONICS SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Control system, Instrumentation and control				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the various Mechatronics system design approaches and its case studies

COURSE OUTCOMES (COs)

CO1	To learn various types of Design processes.
CO2	To understand the concept of Real time interfacing.
CO3	To learn the various case studies on Data Acquisition and control**.**
CO4	To learn the various case studies on Mechatronics Products.
CO5	To learn the concept of advance application in Mechatronics.
CO6	To Understand the concept of Mechatronics systems and Design of the system by the flowchart.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H						L	
	CO2	M			M	H		M					
	CO3				M	H							
	CO4				M	H			M				
	CO5				M	H							
	CO6			M	M	H						L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Introduction to Mechatronics system – Key elements – Mechatronics Design process – Types of Design – Traditional and Mechatronics designs – Advanced approaches in Mechatronics - Man machine interface, industrial design and ergonomics, safety.

UNIT II REAL TIME INTERFACING 9

Introduction - Elements of data acquisition and control - Overview of I/O process –

Overframing.Selection of interface cards--DAQ card-single channel-multichannal-RS232/422/485communication- IEEE 488 standard interface-GUI card-GPIB-Ethernet switch - Man machine interface

UNIT III CASE STUDIES ON DATA ACQUISITION AND CONTROL 10

Case studies on Data Acquisition: Introduction – Cantilever Beam Force Measurement system– Transducer calibration system for automotive applications – Strain gauge weighing system – Solenoid Force-Displacement calibration system.

Case studies on Data Acquisition and control: Introduction – pH control system – Dc-Icing Temperature Control system – Skip control of a CD player – Auto focus Camera, exposure control.

UNIT IV CASE STUDIES ON DESIGN OF MECHATRONIC PRODUCTS 9

Introduction–Fuzzy based Washing machine – Autofocus Camera, exposure control– Motion control using D.C.Motor & Solenoids – Engine management systems. – Controlling temperature of a hot/cold reservoir using PID- Control of pick and place robot – Part identification and tracking using RFID – Online surface measurement using image processing

UNIT V ADVANCED APPLICATIONS IN MECHATRONICS DESIGN 8

Introduction–Sensors for condition Monitoring – Mechatronic Control in Automated Manufacturing – Artificial intelligence in Mechatronics – Fuzzy Logic Applications in Mechatronics – Microsensors in Mechatronics

TEXT BOOKS:

1. Devdas shetty, Richard A. Kolk, "Mechatronics System Design", Thomson Learning Publishing Company, Vikas publishing house, 2001.

REFERENCES

1. Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999.
2. Brian Morriss, Automated Manufacturing Systems - Actuators, Controls, Sensors and Robotics, Mc Graw Hill International Edition, 1995.
3. Bradley, D.Dawson, N.C. Burd and A.J. Loader, Mechatronics: Electronics in Products and Processes, Chapman and Hall, London, 1991.

BMT011	**PRODUCT DESIGN AND COSTING**	**L**	**T**	**P**	**C**
	Total Contact Hours -45	3	0	0	3
	Prerequisite – Operations Research, Industrial Engineering				
	Course Designed by – Dept of Mechatronics				
OBJECTIVES To gain knowledge on various aspects of product design and product modeling techniques					
COURSE OUTCOMES (COs)					
CO1	To learn the basic concepts used for product design				
CO2	To understand the economic necessities of product design				
CO3	To study about the techniques of product modeling and types of product models				
CO4	To learn the fundamental aspects of product costing				

CO5	To study the FEM fundamental regarding product design												
CO6	To learn about the recent advancements of product design												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H										
	CO2	H	M	H	H								
	CO3	M	M		H			M					
	CO4	M		M								M	
	CO5	H		H	M	M							
	CO6											M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PRODUCT DESIGN AND DEVELOPMENT 8

Principles of creativity in design- integrated product development and concurrent engineering – Product analysis – Criteria for product design – Market research – Design for customer and design for manufacture – Product life cycle.

UNIT II ECONOMICS OF DESIGN 9

Breaks even point - Selection of optimal materials and processes – Material layout planning – Value analysis – Re-engineering and its impact on product development.

UNIT III PRODUCT MODELING 9

Product modeling – Definition of concept - fundamental issues – Role and basic requirement of process chains and product models –Types of product models – model standardization efforts – types of process chains – industrial demands.

UNIT IV PRODUCT COSTING 10

Bill of materials – Outline Process charts – Concepts of operational standard time - Work measurement by analytical estimation and synthesis of time – Budgets times – Labor cost and material cost at every stage of manufacture – W.I.P. costing

UNIT V RECENT ADVANCES AND CONCEPTS IN PRODUCT DESIGN 9

Fundamentals of FEM and its significance to product design – Product life cycle management – Intelligent information system – Concept of Knowledge based product and process design.

TEXTBOOKS:

1. Karl T. Ulrich, Stephen D. Eppinger – "Product Design and Development", McGraw-Hill, 2nd Edition 2009.

REFERENCES

1. HARRY NYSTROM, "Creativity and Innovation", John Wiley & Sons, 1979
2. George E. Dieter, "Engineering Design – Materials and process approach", Tata McGraw-Hill, 1991
3. Donald E. Carter, "Concurrent Engineering", Addison Wesley, 1992
4. Sameul Eilon – "Elements of Production Planning and Control", McMillan and Company, 1962

5. Jones S.W., "Product Dosing and Process Selection", Butterworth Publications, 1973

BMT012	**ARTIFICIAL INTELLIGENCE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Sensor and Signal Processing, Robotic and Machine Vision				
	Course Designed by – Department of Mechatronics				

OBJECTIVES: To introduce the various concepts about the Artificial Intelligence

COURSE OUTCOMES (COs)

CO1	To learn pattern recognition
CO2	To learn about game playing
CO3	To learn knowledge representation
CO4	To learn about knowledge representation using other logic
CO5	To learn structural representation of knowledge
CO6	To understand the various applications of Artificial Intelligence

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H							H	H	
	CO3		M		H								
	CO4					M	H					H	
	CO5							H	H			H	
	CO6			H		M						L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)

						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 10

Definition – Pattern recognition – Criteria of success – Production Systems – Control Strategies – Heuristic Search – Problem Characteristics – Production System Characteristics – Forward and backward reasoning – Matching Indexing – Heuristic Functions, Search algorithms.

UNIT II GAME PLAYING 8

Overview – Minimax search procedure – Adding Alpha – Beta cutoffs – Waiting for Quiescence – Secondary search – Using book moves.

UNIT III KNOWLEDGE REPRESENTATION 10

Use of Predicate logic – Introduction to representation – representing simple facts in logic augmenting the representation – resolution – Conversion to clause from – The basis of resolution Unification of algorithm – Question answering – Natural Deduction.

UNIT IV KNOWLEDGE REPRESENTATION USING OTHER LOGICS 8

Nonmonotonic reasoning – Statistical Probabilistic reasoning – Techniques for dealing with a random world and deterministic world – rule based system.

UNIT V STRUCTURAL REPRESENTATIONS OF KNOWLEDGE 9

Common knowledge structures – level of representation – Right structures – Declarative representations – Semantic nets – Conceptual dependency Frames Scripts – Procedural representation – Natural language understanding – Perception – learning – Implementation A.I. Systems.

TEXTBOOKS:

1. ELAINE RICH, Artificial Intelligence, McGraw-Hill Book Co., 3rd Edition, 2008.

REFERENCE:

1. M. W. RICHAUGH, Artificial Intelligence, A. Knowledge Based Approach, PWS Rent Publishing Boston, 1998.

2. CHARNIAC. E and M.C.DERMOTT. Introduction to Artificial Intelligence, Addison Wesley Publishing Company, 2002.

3. ROBERT GOODELL BROWN, Materials Management Systems – A Members Library John Wiely Publishers, 1977.

4. WESTING FINE and ZONE, Purchasing Management Principles, John Wiley Publishers, 1986.

NON MAJOR ELECTIVE-II

BMT013	**MEDICAL MECHATRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Instrumentation & Control, Electronic Devices and Circuits				

	Course Designed by – Dept of Mechatronics

OBJECTIVES

To study about transducers. To study about medical support devices. To study about diagnostic instruments.

COURSE OUTCOMES (COs)

CO1	To learn basics about electrodes.
CO2	To learn about transducers in Medical Mechatronics.
CO3	To learn about amplifiers &recorders.
CO4	To learn about medical support devices.
CO5	To understand the biomedical diagnostic instrument.
CO6	To Understand the concept of Medical Instruments and circuits and we know its usage.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H							
	CO2	M			M				H				M
	CO3				M	H		M					
	CO4								H			M	M
	CO5				M	H							
	CO6			M									

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT 1 INTRODUCTION 9

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.

UNIT 1I TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION 9

Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio & Nano sensors & application

UNIT 1II SIGNAL CONDITIONING, RECORDING AND DISPLAY 9

Input isolation, DC amplifier, power amplifier, and differential amplifier – feedback, op-Amp-electrometer amplifier, carrier Amplifier – instrument power supply. Oscillagraphic – galvanometric - X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems – Telemetry principles – Bio telemetry.

UNIV IV MEDICAL SUPPORT 10

Electrocardiograph measurements – blood pressure measurement: by ultrasonic method – plethysonography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – Bio-telemetry – laser equipment and application – cardiac pacemaker – DC – defibrillator patient safety - electrical shock hazards. Centralized patent monitoring system.

UNIV V BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION 8

Introduction – computers in medicine – basis of signal conversion and digital filtering data reduction technique – time and frequency domain technique – ECG Analysis.

TEXT BOOKS :

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TMH, 1989.2nd Edition.
2. Arumugam M., "Bio Medical Instrumentation", Anuradha agencies Pub., 2002.2nd Edition.

REFERENCES :

1. Geddes L.A., and Baker, L.E., "Principles of Applied Bio-medical Instrumentation", 3rd Edition, John Wiley and Sons, 1995.
2. Cromwell, Weibell and Pfeiffer, "Biomedical Instrumentation and Measurements", 2nd Edition, Prentice Hall of India, 1999.
3. Tompkins W.J., "Biomedical Digital Signal Processing: Principles and Techniques", Prentice Hall of India, 1998.

BMT014	**CONSUMER ELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Digital Electronics				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the operation of audio, video systems. To learn the operation of various memory devices and various switching systems. Able to conduct experiments on electrical machines and analyze the experimental data

COURSE OUTCOMES (COs)

CO1	To learn various sound systems like stereophonic, Quadraphonic, recording
CO2	To learn various video systems like cameras, VCR, VCP, TV etc
CO3	To study various memory devices like CD, HDD etc
CO4	To learn switching system in telephone exchange
CO5	To study the home appliances like oven, Refrigerators, washing machines
CO6	To Understand the concept of various sound systems and various memory devices.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H		M					
	CO2	M			M						H		
	CO3						M		H				

	CO4					H					L		M
	CO5				M						H		
	CO6			M									
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
										√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I AUDIO SYSTEM 9

Hi-Fi systems, stereophonic sound system, public address systems, Acoustics, Quadraphonic sound systems, Graphics Equalizer, Electronic tuning, Digital sound recording on tape and disc..

UNIT II VIDEO SYSTEMS 9

B & W TV, colour TV and HD TV systems, Electric cameras, VCR, VCP, Block diagram and principles of working of cable TV and DTH, cable TV using internet.

UNIT III MEMORY DEVICES 10

CD systems, Memory diskettes, Discs and drums vide monitoring audio, video recording media & Systems.

UNIT IV SWITCHING SYSTEMS 9

Dolby noise reduction digital and analog recording. Switching Systems: Switching systems for telephone exchange, PAB EPRABX, modular telephones, Telephone message recording concepts, remix controlled systems.

UNIT V HOME APPLIANCES 8

Electronic toys, microwave oven, Refrigerators, washing machines, calculator, data organizers

TEXT BOOKS

1. Gulati.R.R, Monochrome and color television, New age publisher.2nd Edition
2. Encyclopedia of video & TV / Focal press

REFERENCES

1. Complete Satellite & cable Television R.R Gulati New age International Publisher.
2. Handbook of Electronics & Telecommunication.

	DIGITAL SIGNAL PROCESSING	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
BMT015	Prerequisite – Engg Mathematics-I, Engg Mathematics –III& Signals and Systems				

	Course Designed by – Dept of Mechatronics
OBJECTIVES: To learn the operation of various DSP devices. To understand the Design Algorithm of various filters.	
COURSE OUTCOMES (COs)	
CO1	To learn about Characterization and classification of signals
CO2	To learn about Discrete Fourier Transform (DFT)
CO3	To study about Various design method of FIR Filters
CO4	To study about Various design method of IIR Filters
CO5	To Study about Various Digital Signal Processors
CO6	To Understand the concept of Discrete Fourier Transform and various design method of IIR Filters.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H		M					
	CO2	M			M			H					
	CO3						M		H				
	CO4					H		M			L		M
	CO5				M		H		M	H			
	CO6			M									

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CLASSIFICATION OF SIGNALS 9

Characterization and classification of signals – examples of signals – continuous versus discrete – analog versus digital – advantages of digital signal processing compared with analog processing- Sampling of Analog Signals – Aliasing.Linear Time Invariant Systems (LTIS) – Linearity – Time Invariant – Causality – stability – Response of CT – LTI System using Convolution Integral Response of DT – LTI system using convolution SUM – Finding Impulse Response of LTI using Laplace Transform – Z – Transform & its Properties- Finding Impulse Response of DT – LTI system using Z – transform.

UNIT II FAST FOURIER TRANSFORM 9

Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and Laplace Transform in signal analysis. Spectrum of D.T. signals, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT) – Introduction to radix – 2 FFT – DIT & DIF radix 2 FFT.

UNIT III FIR FILTER DESIGN 9

FIR Filters: Design of Filters – Frequency selective filters – Linear filtering – Structures for FIR – Design of FIR Filters – using windows – Frequency Sampling – Linear phase FIR Filters.

UNIT IV DIGITAL FILTER DESIGN 9

Review of design of analogue Butter worth and Chebyshev Filters, Frequency transformation in analogue domain – design of IIR digital filters using impulse invariance technique – Design of digital filters using bilinear transform – Pre warping – Frequency transformation in digital domain – Realization using direct, cascade and parallel forms.

UNIT V DSP PROGRAMMING 9

Effect of Number representation on Quantization – Overflow – Need for scaling – truncation error – coefficient Quantization error – limit cycle oscillations. Multichannel – Multi – dimensional – typical applications of DSP – Introduction to Programmable DSP – Instruction set of TMS 320C50.

TEXT BOOKS :

1. Sanjith K. Mitra "Digital Signal Processing", Tata McGraw–Hill, New Delhi, 3rd Edition, 2007.

REFERENCES :

1. Allan V.Oppenheim & Donald W. Schafer, "Digital Signal Processing", PHI of India, 1989.
2. Texas Instruments, User Guide TMS 320C50.
3. Ludemann L.C. "Fundamentals of Digital Signal Processing", John Wiley Inc., 1992.
4. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing, Algorithms and Application", PHI of India Ltd., New Delhi 3rd Edition 2000.

OPEN ELECTIVE-I

BMT016	**DIGITAL IMAGE PROCESSING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engineering Mathematics-I, Sensors and Signal Processing Lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES:

To introduce the basic concepts of Digital Image Processing and various techniques used to resolve the images

COURSE OUTCOMES (COs)

CO1	To learn Fundamentals of Digital Images and the ways to represent it
CO2	To learns the various ways of representing image enhancement in spatial domain
CO3	To learn the concept of image enhancement in frequency domain
CO4	To study about the image compression techniques

CO5	To learn the various methods to specify image boundaries												
CO6	To understand the various techniques to segment the images												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H							
	CO2	L				H							
	CO3				M	H							
	CO4	L			M	H							
	CO5				M	H							
	CO6				H	H					L	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
									√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I FUNDAMENTALS 8

What is Digital image processing, Examples (Briefly), Components of Image Processing System, Light and electromagnetic spectrum, Image Sensing and Acquisition, Simple Image Formation Model, Image Sampling and Quantization:- Representing Digital Images, Spatial and Grey level Resolution, Basic Relationship Between Pixels.

UNIT II IMAGE ENHANCEMENT IN SPATIAL DOMAIN 9

Background, some Basic Grey Level Transformation:- Image Negatives, Log negatives, Piecewise – Linear Transformation Functions:- Contrast stretching, Grey level Slicing, Bit Plane Slicing, Histogram processing: - Histogram Equalization, Histogram Specification, Local Enhancement.

UNIT III IMAGE ENHANCEMENT IN FREQUENCY DOMAIN 9

Two dimensional DFT and its Inverse, Filtering the frequency domain, Basics of filtering in frequency domain, smoothing and sharpening filters. Color Image Processing:- Color Fundamentals and Color Models.

UNIT IV IMAGE COMPRESSION 9

Fundamentals, Coding Redundancy, Interpixel Redundancy Psycho-Visual Redundancy, Image Compression Models, Error Free Compression, Variable – Length Coding, Huffman Coding, Arithmetic Coding, Run-length coding, Lossy Compression, Transform coding, JPEG.

UNIT V IMAGE SEGMENTATION 10

Detection of Discontinuous, Edge linking and Boundary Detection:- Local Processing, Thresholding:- Basic Global Thresholding, Region Based Segmentation:- Region Growing, Region Splitting and Merging, Use of Motion In Segmentation.

TEXTBOOKS:

1. Digital image processing by Rafael C. Gonzale Z, Richard E.Words, Pearson Education, Asia,3rd Edition, 2008.

REFERENCES

1. Fundamental of Digital Image Processing by Anil. K. Jain, Prentice Hall of India Publishing Ltd., New Delhi, 2002. 7th Edition.

BMT017	**NETWORKING OF COMPUTERS**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									3	0	0	3
	Prerequisite – Fundamentals Computing &Digital Electronics												
	Course Designed by – Dept of Mechatronics												
OBJECTIVES: To understand the various concepts in computer network protocols													
COURSE OUTCOMES (COs)													
CO1	To understand the concept of networks and its topologies												
CO2	To understand the concept of various types of data communication												
CO3	To learn the concept of various types of network layers												
CO4	To learn the concept of TCP/IP Networking												
CO5	To understand the concept of broad band Network and connectivity												
CO6	To understand the concepts of various application of networking												

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H				L			
	CO2				M	H							
	CO3				M	H				L			
	CO4				M	H							
	CO5				M	H						L	
	CO6				M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I OPEN SYSTEM INTERCONNECTION MODEL 9

Network Goals – uses – network topologies –Network architecture- OSI Reference model services – Network standardization – ARPANET – SNA – USENET

UNIT II DATA COMMUNICATIOM CONCEPTS 9

Guided and unguided Medias – Asynchronous and synchronous transmission – RS232C Interface, X.21 interface switching technologies – Circuit, Message, packet and hybrid switching – Elementary data link protocols – sliding window – Automatic repeat request.

UNIT III MEDIUM ACCESS SUB-LAYER AND NETWORK LAYER 9

Channel allocation methods – ALOHA protocols – Pure ALOHA – Slotted ALOHA – local area networks – IEEE standard 802 for LANS – Wireless LAN IEEE 802.11 FDD1 - Virtual circuits – datagram – comparison – Routing congestion control.

UNIT IV. TCP/IP –AND INTERNETWORKING 9

TCP/IP – architecture and operation – The IP layers and functions – addressing and routing – Internet user services – E-Mail – w.w.w. Internetworking – Bridges – Gateways – Repeaters – Routers – Brouters.

UNIT V BROAD BAND NETWORKS AND CONNECTIVITY 9

ISDN Evolution – structures – Limitation Broad-bannd ISDN, Transfer modes – Asynchronous transfer mode (ATM) – ATM cell format – Traffic Management – SONET – Introduction to VSAT networks.

TEXTBOOKS:

1. Andrew S. Tanenbaum, "Computer Networks", Prentice Hall of India, 3rd edition, 1998, (UNITS I to IV)
2. Balaji Kumar, "Broad band Communication", McGraw-Hill, 1996. (UNIT V)

REFERENCES :

1. Dimetri Bertsekas and Robert Gallager, "Data Networks", PH1, 1994.
2. Hughes.L. "Data Communication A Practical Approach", Narosa Publications 1997.

BMT008	**COMPUTATIONAL FLUID DYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Mathematics, Mechanics of solids and Fundamentals of Fluids				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES: To understand the various concepts in mathematical models for fluid dynamics.

COURSE OUTCOMES (COs)

CO1	To understand the concept in governing differential equation for fluids
CO2	To understand the concept in various types of discretization method
CO3	To learn the concept of Heat conduction, convection and diffusion in fluids

CO4	To learn the concept of Flow field calculation
CO5	To understand the concept of Turbulence and algebraic models
CO6	To understand the concepts in various application of fluid dynamics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M		M	H							
	CO2	H	M		M	H							
	CO3	H	M		M	H							
	CO4	H	M		M	H							
	CO5	H	M		M	H							
	CO6	H	M		M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I GOVERNING DIFFERENTIAL EQUATIONS 9

Conservation of chemical species-The energy equation-Momentum equation-time averaged equations for turbulent flow-Turbulence-Kinetic energy equation-The general differential equation-Nature of co-ordination-Independent variable-Choice of co-ordinates-one way and two way coordinates

UNIT II DISCRETIZATION METHODS 9

Nature of numerical methods-Methods of deriving of discretization equations-Taylor series formulation-Variational formulation-Methods of weighted residuals-Control volume formulation

UNIT III HEAT CONDUCTION, CONVECTION AND DIFFUSION 9

Steady One Dimensional Conduction- Two and three dimensional conduction-Steady one dimensional convection and diffusion-Discretization equations for two dimensional convection and diffusion

UNIT IV CALCULATION OF FLOW FIELD 9

Representation of pressure-gradient and continuity equation-stagged grid-momentum equations-pressure and velocity correction-pressure correction equation.Introduction to Finite Element Method-solution of steady heat conduction by FEM-incompressible flow-simulation by FEM.

UNIT V TURBULENCE AND ALGEBRAIC MODELS 9

One, two equation model-high and low Reynolds number models-Reynolds stress models-Prediction of fluid and heat transfer using standard codes.

REFERENCES

1. K.Muralidhar & T.sundarrajan-Computational Fluid Flow and Heat Transfer-Narosa, reprint 2009.
2. P.S.Ghoshdastidar-Computer Simulation of Flow and Heat Transfer-Tata Mcgrawhill Publishing Company Ltd 1998.
3. H.K.Versteeg & W.Malalasekara-An Introduction to Computational Fluid Dynamics-Longman

BBA001	**PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

- Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior

COURSE OUTCOMES (COs)

CO1	Understanding the concepts of Management
CO2	Knowledge on Management Functions
CO3	Understanding the Organization Theory & Approach.
CO4	Knowledge on the Concepts of Motivation
CO5	Clear insight on the factors contributing to discipline
CO6	In-depth Understanding about the concepts of Group Behavior

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H			M				H	L
	CO2			H	H			M				H	L
	CO3			H	H			M				H	L
	CO4			H	H			M				H	L
	CO5			H	H			M				H	L
	CO6			H	H			M				H	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)

								√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT -I NATURE OF MANAGEMENT 9

Definition – theory and practice – effective management – Management : Science of Art – Management in India. Development of Management thoughts – Taylor's – Henry Fayol – Hawthrone experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

UNIT- II MANAGEMENT PROCESS 9

Co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierarchy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

UNIT- III ORGANIZATION STRUCTURE 9

Organizing – Theory & Approach –Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow's Hersberg's MaClelland's theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

UNIT- IV ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behaviour – Causes – Environmental effect – Behaviour and performance, perception – Organizational implications, Personality – Contributing factors – Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behaviour – Learning Curves, Work Design and Approaches.

UNIT -V GROUP BEHAVIOUR 9

Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

TEXT BOOKS:

1. Herald Knootz and Heinz Weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition, 2004.
2. Ties AF, Stoner and R. Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.

REFERENCE BOOKS :

1. Joseph I. Massie 'Essentials of Management', Prentice Hall of India Pvt. Ltd., New Delhi - 110011, 2004.
2. L.M. Prasad "Principles and Practice of Management", Sultan Chand & Sons.2001
3. Uma Sekaran, "Organizational Behaviour", Tata McGraw Hill, 2007
4. https://www.extension.harvard.edu

BBA010	**STATISTICAL QUALITY CONTROL**										**L**	**T**	**P**	**C**
	Total Contact Hours - 45										3	0	0	3
	Prerequisite – Basic Mathematics and Mathematics III													
	Course Designed by – Dept of Mathematics													

OBJECTIVES

Familiarize the students with statistical quality control and quality improvement

COURSE OUTCOMES (COs)

CO1	To gain knowledge of probability concepts and distributions
CO2	To gain knowledge in control charts for variables
CO3	To gain knowledge in control charts for attributes
CO4	To gain knowledge in acceptance sampling
CO5	To gain knowledge about IS standards
CO6	To gain knowledge of quality management

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H			M					
	CO2	H	H		H			M					
	CO3	H	H		H			M					
	CO4	H	H		H			M					
	CO5	H	H		H			M					
	CO6	H	H		H			M					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION 7

Probability concepts, Review of distribution: Normal, Poison's, and Binomial, Problems, Measuring of quality and control, Value and quality, Quality costs, Quality assurance.

UNIT II CONTROL CHARTS FOR VARIABLES 10

Chance and assignable causes of quality variation, Control charts for variables, X-bar, R, and σ-charts, Warning and modified control limits, Process capability study, Ranges, Moving Averages, and Six σ- limits, multivariate charts.

UNIT III CONTROL CHARTS FOR ATTRIBUTES 8

Limitation of variable chart, p-chart, problems with variable sample size, np-chart, c- chart, u-chart, and ku-chart, Demerits per unit control chart.

UNIT IV ACCEPTANCE SAMPLING 10

Economics of sampling, Lot formation, OC-Curve-Producer's and Consumer's risk, Single and double sampling plans, AOQ, AOQL, ATI, ASN, Sequential sampling plan, MIL – STD – 1050 tables, MIL – STD – 414 tables, IS 2500 Standard.

UNIT V QUALITY IMPROVEMENT 10

Zero defects program, Quality circle, Fishbone diagram, scatter diagram, Pareto Analysis, Deming cycle, Introduction to Reliability function, System reliability of series, parallel, and combined configurations, Reliability improvement techniques.

TEXTBOOKS:

1. Grant E.L. and Leavensworth, "Statistical Quality Control", Tata McGraw-Hill Publishing Company, 2008.

REFERENCE:

1. Douglas C. Montgomery, "Statistical Quality Control", John Wiley and Sons, 2012
2. Fiegenbaum, A.V., "Total Quality Control", McGraw-Hill Inc., 1991.
3. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, New Delhi (1998).
4. Srinath L.S, "Reliability Engineering", Affiliated East west Press, 1998.

BBA002	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management studies				

OBJECTIVES

Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

COURSE OUTCOMES (COs)

CO1	To gain knowledge of Entrepreneurship
CO2	To gain knowledge of Motivation
CO3	To gain knowledge in Business
CO4	To gain knowledge of Market survey
CO5	To gain knowledge in financing and accounting
CO6	To gain knowledge in support to entrepreneurs

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	M			H		L	M	H	M
	CO2			H	M			H		L	M	H	M

	CO3			H	M			H		L	M	H	M
	CO4			H	M			H		L	M	H	M
	CO5			H	M			H		L	M	H	M
	CO6			H	M			H		L	M	H	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
											√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I ENTREPRENEURSHIP 8

Entrepreneur- Types of Entrepreneurs - Difference Between Entrepreneur and Interpreneur- Role of Entrepreneurship in Economic Growth- Women and Rural Entrepreneurship - Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 8

Major Motives Influencing Entrepreneur – Achievement Motivation Training, Self Rating – Business Game – Thematic Apperception Test – Stress Management – Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprise – Definition, Classification – Characteristics- Ownership Structure – Project Formulation – Steps Involved in Setting up a Business – Identifying, Selecting a Good Business Opportunity- Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports- Project Appraisal- Sources of Information- Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 10

Need – Sources of Finance- Terms Loans, Capital Structure- Financial Institutions, Management of Working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/ CPM –Taxation – Income Tax – Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 10

Sickness in Small Business- Concept, Magnitude, Causes and Consequences, Corrective Measures- Government Policy for Small Scale Enterprises- Growth Strategies in Small Industry – Expansion- Diversification, Joint Venture, Merger, Sub Contracting.

TEXTBOOKS:

1. S.S.Khanka, "Entrepreneurial Development", S. Chand & Co. Ltd., Ram Nagar, New Delhi, 1999.
2. Hisrich RD and Peters MP, "Entrepreneurship", 7th Edition, Tata McGraw Hill, 2008.

REFERENCES

1. Rabindra Kanungo, "Entrepreneurship and Innovation" , Sage Publications, New Delhi, 1999 ED II. Faculty & External Experts-A Hand book for New Entrepreneurs Publishers: Entrepreneurial Development, Institute Of India, and Ahmedabad, 1986

BBA009	**INTELLECTUAL PROPERTY RIGHTS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Value Education and Professional Ethics & Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

Strong intellectual property rights (IPR) protection is crucial to fostering trade, and achieving the goals and benefits of global integration. Countries with high standards of IPR protection tend to attract more investment, stimulate more innovation, thereby developing more rapidly. Countries with inadequate protection are often vulnerable to infringements of intellectual property rights that hinder trade flow and economic development.

Hence, the objective is to introduce IPR to the UG Engineering and Technology students.

COURSE OUTCOMES (COs)

CO1	Understand the principles, function and basic legal rules of IP Law.
CO2	Recognize the relevant criteria for generating and protecting intellectual works.
CO3	Recognize the intellectual property likely to be produced in the academic and professional environment.
CO4	Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.
CO5	Understand the relevance and impact of IP Law on academic/scientific works/studies.
CO6	Understand the different forms of infringement of intellectual property rights.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6	H			H					M			L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I PROPERTIES AND TYPES 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property ii.Immovable Property and iii.Intellectual Property.

UNIT II PATENTS AND RIGHTS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

UNIT III INTERNATIONAL TRADE 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV WTO 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOKS:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.
4. www.ipmatters.net/features/000707_gibbs.html.
5.http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf

OPEN ELECTIVE-II

BBA003	**MARKETING MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				
OBJECTIVES: Study of this subject provides an understanding of the marketing, supply and demand, pricing, marketing research, advertising, sales promotion and distribution.					
COURSE OUTCOMES (COs)					
CO1	To introduce the supply and demand and selling Vs Marketing				
CO2	To understand the buying behavior and marketing segmentation				

CO3	To understand the product pricing and marketing research
CO4	To understand the marketing planning and strategy formulation
CO5	To gain knowledge about advertising and sales
CO6	To gain knowledge about distribution of the product

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		L	H	M			H	M				
	CO2		L	H	M			H	M				
	CO3		L	H	M			H	M				
	CO4		L	H	M			H	M				
	CO5		L	H	M			H	M				
	CO6		L	H	M			H	M				

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Definition- Marketing Process- Dynamics- Needs- Wants and demands-Marketing Concepts- Environment- Mix- Types- Philosophies- Selling Vs Marketing- Organizational- Industrial Vs Consumer Marketing- Consumer Goods- Industrial Goods- Product Hierarchy.

UNIT II BUYING BEHAVIOUR & MARKET SEGMENTATION 9

Cultural- Demographic Factors- Motives- Types- Buying Decisions- Segmentation factors- Demographic- Psychographic & Geographic Segmentation- Process- Patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives- Pricing- Decisions & Pricing Methods- Pricing Management- Introduction- Uses- Process of Marketing Research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan- Strategy formulation and marketing process- Implementation- Portfolio analysis- BCG- GEC grids.

UNIT- V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics- Impact- Goals- Types- Sales promotion- Point of Purchase- Unique selling proposition- Characteristics- Whole selling- Retailing- Channel Design- Logistics- Modern trends in retailing

TEXTBOOKS:

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context",5th Edition, 2014
2. Govindarajan.M, "Industrial marketing management:", Vikas Publishing Pvt. Ltd, 2009

REFERENCES

1. Philip Kotler, Marketing Management, Analysis, Planning, Implementation and control, 1998.
2. Khanna O.P. – Industrial Engineering and Management, Khanna Publishers, New Delhi, 2000.
3. Green Paul.E and Donald Tull, "Research for marketing decisions", Prentice Hall of India. 1995
4. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of India- 1997

BBA008	**TOTAL QUALITY MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

1. To introduce to the student about the basic terms related to quality and concepts of quality management
2. To familiarize the student about the basic principles of total quality management
3. To acquaint the student with the basic statistical tools used in process control
4. To introduce to the student about the various tools used in implementing and checking total quality management
5. To familiarize the student about the different quality systems used in auditing the quality of a company/industry/organization

COURSE OUTCOMES (COs)

CO1	By understanding about various quality terms, it will be helpful for the student to maintain quality in his/her organization
CO2	The student will be able to formulate new plans/procedures to be implemented to achieve the desired quality status by knowing about the various principles of quality management
CO3	The student will be able to analyze the periodical data in quality control using statistical tools
CO4	The total quality management tools will help the student to understand the procedures in measuring the quality of the organization/process and will also enable him/her to identify the parameters that are improving/depriving the quality
CO5	By knowing about the quality ISO systems, the student will be maintain processes/documentation properly so that the quality maintained by his/her organization gets recognized
CO6	To understand the concept about ISO standards

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – AnalysisTechniques for Quality Costs, Basic concepts of Total Quality Management, HistoricalReview, Principles of TQM, Leadership – Concepts, Role of Senior ManagementQuality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers toTQM Implementation

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, ServiceQuality, Customer Retention, Employee Involvement – Motivation, Empowerment,Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development,Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendencyand Dispersion, Population and Sample, Normal Curve, Control Charts for variables andattributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality FunctionDeployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality LossFunction, Total Productive Maintenance (TPM) – Concept, Improvement Needs, and FMEA –Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System –Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits

TEXTBOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc.2003. (Indian

reprint 2004). ISBN 81-297-0260-6.

REFERENCES :

1. Evans. J. R. & Lindsay. W,M "The Management and Control of Quality", (5th Edition),South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S. "Total Quality Management", Butterworth Heinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks", New Age International 1996.
5. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.

BBA006	**INDIAN CONSTITUTION AND SOCIETY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management studies				

OBJECTIVES

To know about Indian constitution. To know about central and state government functionalities in India. To know about Indian society.

COURSE OUTCOMES (COs)

CO1	To understand the historical background and fundamental rights
CO2	To understand the structure and functions of governments
CO3	To understand the Indian social structure
CO4	To gain knowledge in Indian federal system
CO5	To gain knowledge Indian social structure
CO6	To gain knowledge the right of women, children and SC&ST

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M	M			L		M
	CO2			H			M	M			L		M
	CO3			H			M	M			L		M
	CO4			H			M	M			L		M
	CO5			H			M	M			L		M
	CO6			H			M	M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I HISTORY 9

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II CENTRAL STRUCTURE 9

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STATE STRUCTURE 9

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV PARLIMENTARY SYSTEM 9

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V SOCIAL STRUCTURE 9

Society : Nature, Meaning and definition; Indian Social Structure; Castle, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

TEXTBOOKS:

1. Durga Das Basu, " Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
2. R.C.Agarwal, " (1997) Indian Political System ", S.Chand and Company, New Delhi.

REFERENCES:

1. Sharma, Brij Kishore, "Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, "(1998) Indian Political System ", New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.
4. Yogendra Singh, "(1997) Social Stratification and Charge in India ", Manohar, New Delhi
5. Maciver and Page, "Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
6. K.L.Sharma, " (1997) Social Stratification in India: Issues and Themes ", Jawaharlal Nehru University, New Delhi.

BBA007	**ENGINEERING ECONOMICS AND COST ANALYSIS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

The main objective of this subject is to make the engineering student know about the basic law of economics, how to organize a business, the financial aspects related to business, different methods of appraisal of projects and pricing techniques. At the end of this course the student shall have the knowledge of how to start a construction business, how to get finances, how to

account, how to price and bid and how to access the health of a project.													
COURSE OUTCOMES (COs)													
CO1	To understand the Economics												
CO2	To understand the value engineering												
CO3	To gain knowledge in cash flow												
CO4	To gain knowledge replacement and maintenance analysis												
CO5	To gain knowledge depreciation												
CO6	To gain knowledge inflation												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H	L		M	H					L
	CO2	M		H	L		M	H					L
	CO3	M		H	L		M	H					L
	CO4	M		H	L		M	H					L
	CO5	M		H	L		M	H					L
	CO6	M		H	L		M	H					L
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
											√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING 10

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW 9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash

flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TEXT BOOKS :

1. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES :

1. Chan S.Park, Contemporary Engineering Economics, Prentice Hall of India, 2002.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg, Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, Engineering Economy, Macmillan, New York, 1984.
4. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, Principles of Engineering Economy, Ronald Press, New York,1976.
5. Smith, G.W., Engineering Economy, Lowa State Press, Iowa, 1973.