INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Accredited by NBA | Affiliated to JNTUH)

Dundigal, Hyderabad - 500 043, Telangana

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

MASTER OF TECHNOLOGY

CAD / CAM

(COMPUTER AIDED DESIGN/ COMPUTER AIDED MANUFACTURING)

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI

(Based on AICTE Model Curriculum)

IARE - R18

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2018 - 2019)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

INSTITUTE VISION | MISSION | QUALITY POLICY

VISION

To bring forth professionally competent and socially sensitive engineers, capable of working across cultures meeting the global standards ethically.

MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

QUALITY POLICY

Our policy is to nurture and build diligent and dedicated community of engineers providing a professional and unprejudiced environment, thus justifying the purpose of teaching and satisfying the stake holders.

A team of well qualified and experienced professionals ensure quality education with its practical application in all areas of the Institute.

DEPARTMENT VISION | MISSION

VISION

The Department of Mechanical Engineering envisions value based education, research and development in the areas of Manufacturing and Computer Aided Engineering as an advanced center for Mechanical Engineering, producing graduates of world-class competence to face the challenges of global market with confidence, creating effective interface with various organizations.

MISSION

The mission of the Mechanical Engineering Department is to prepare effective and responsible engineers for global requirements by providing quality education and to improve pedagogical methods employed in delivering the academic programs to the needs of the industry and changing world by conducting basic and applied research and to generate intellectual property.

M.TECH (CAD / CAM) - PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

The students of M.Tech CAD / CAM are prepared to:

PEO - I	Impart essential knowledge in the latest technological topics on computer aided engineering and to prepare them for taking up further research in the areas.
PEO - II	Create congenial environment that promotes learning, growth and imparts ability to work with inter-disciplinary groups.
PEO - III	Broaden and deepen their capabilities in analytical and experimental methods, analysis of data, and draw relevant conclusions for scholarly writing and presentation.

M.TECH - PROGRAM OUTCOMES (PO's)

Upon completion of M.Tech Degree, the students will be able to:

PO - 1	An ability to independently carry out research /investigation and development wor solve practical problems.
PO - 2	An ability to write and present a substantial technical report/document.
PO - 3	Students should be able to demonstrate a degree of mastery over the area as per specialization of the program. The mastery should be at a level higher than requirements in the appropriate bachelor program.
PO - 4	Identify, formulate and solve complex problems on modern-day issues of CAD/C systems using advanced technologies with a global perspective and envisage researc emerging thrust areas.
PO - 5	Model and apply appropriate techniques using modern tools on contemporary issue multidisciplinary environment
PO - 6	Engage in life-long learning for continuing education in doctoral level studies professional development.

CONTENTS

"Take up one idea.
Make that one idea you're life-think of it, dream of it, and live on that idea.
Let the brain muscles, nerves, every part of your body be full of that idea
and just leave every other idea alone.
This is the way to success" Swami Vivekananda

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two consecutive semesters i.e., Even and Odd semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

Betterment: Betterment is a way that contributes towards improvement of the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Certificate course: It is a course that makes a student gain hands-on experience and skill required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards internal assessment.

Course: A course is a subject offered by the University for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed upto two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources and processes for evaluating the attainment of Program Educational Objectives.

Degree with Specialization: A student who fulfills all the program requirements of her/his discipline and successfully completes a specified set of professional elective courses in a specialized area is eligible to receive a degree with specialization like Structural Engineering, Embedded Systems, CSE, etc.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Detention in a course: Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

Dropping from the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 point scale.

Institute: Means Institute of Aeronautical Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Master of Technology (M.Tech) degree program / UG degree program: B.Tech.

Program Educational COURSE OBJECTIVES: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her second year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all M.Tech programs offered by Institute are designated as "IARE-R18" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of the odd or even semester (deadlines are different for summer sessions). However s/he can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

Words 'he', him', 'his', occur, they imply 'she', 'her', 'hers' also.

FOREWORD

The autonomy is conferred to Institute of Aeronautical Engineering (IARE), Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Hyderabad (JNTUH), Hyderabad and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

IARE is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

ACADEMIC REGULATIONS

M.Tech. Regular Two Year Degree Program
(for the batches admitted from the academic year 2018 - 20)

For pursuing two year postgraduate Master Degree program of study in Engineering (M.Tech) offered by Institute of Aeronautical Engineering under Autonomous status and herein after referred to as IARE.

1.0 CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work /mini project work with seminar/ viva / seminars / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

1. Choose electives from a wide range of elective courses offered by the departments of the Institute.
2. Undergo additional courses of interest.
3. Adopt an inter-disciplinary approach in learning.
4. Make the best use of expertise of the available faculty.

2.0 MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course curriculum in accordance with the prescribed syllabi.

3.0 ELIGIBILITY FOR ADMISSION

The admissions for category A and B seats shall be as per the guidelines of Telangana State Council for Higher Education (TSCHE) in consonance with government reservation policy.

a) Under Category A: 70% of the seats are filled based on GATE/PGECET ranks.
b) Under Category B: 30% seats are filled on merit basis as per guidelines of TSCHE.

4.0 UNIQUE COURSE IDENTIFICATION CODE

Every specialization of the M.Tech programme will be placed in one of the groups as listed in the Table 1.

Table 1: Group of Courses

S. No	Specialization	Offering Department	Code
1	Structural Engineering	Civil Engineering	ST
2	Electrical Power Systems	Electrical and Electronics Engineering	EPS
3	CAD / CAM	Mechanical Engineering	CC
4	Embedded Systems	Electronics and Communication Engineering	ES
5	Computer Science and Engineering	Computer Science and Engineering	CS
6	Aerospace Engineering	Aeronautical Engineering	AE

5.0 TYPES OF COURSES

Courses in a programme may be of four kinds: **Core, Elective, Open and Audit.**

5.1 Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a program in said discipline of study.

5.2 Elective Course:

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

There shall be five professional core elective groups out of which students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses which suit their project work in consultation with the faculty advisor/mentor. In addition, one course from each of the two open electives has to be selected. A student may also opt for more elective courses in his/her area of interest.

5.3 Open Elective Course:

An elective may be discipline centric focusing on those courses which add generic proficiency to the students or may be chosen from supportive/general discipline called as "Open Elective".

5.4 Audit Course:

The value added courses are audit courses offered through joint ventures with various organizations providing ample Scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen fields of study. A plenty of value added programs will be proposed by the departments one week before the commencement of class work. The students are given the option to choose the courses according to their desires and inclinations as they choose the desired items in a cafeteria. The expertise gained through the value added programs should enable them to face the formidable challenges of the future and also assist them in exploring new opportunities. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

6.0 SEMESTER STRUCTURE

The institute shall follow semester pattern. An academic year shall consist of a first semester and a second semester and the summer term. Each semester shall be of 23 weeks (Table 2) duration and this period includes time for course work, examination preparation and conduct of examinations. Each main semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical shall be 75 and 15 days shall be for examination preparation. The duration for each semester shall be a minimum of 17 weeks of instruction. The Academic Calendar is declared at the beginning of the academic year as given in Table2.

Table 2: Academic Calendar

FIRST SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation and Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Exams			2 weeks
SECOND SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 Week	
	Preparation & Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Summer Vacation and Supplementary Exams			4 weeks
THIRD SEMESTER	I Spell Instruction Period	9 weeks	18 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Project Work Phase – I		
	Semester End Examinations		1 week
FOURTH SEMESTER	Project Work Phase - II		18 eeks

7.0 PROGRAM DURATION

A student shall be declared eligible for the award of M.Tech degree, if he/she pursues a course of study and completes it successfully in not less than two academic years and not more than four academic years. A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her seat in M.Tech course.

a) A student will be eligible for the award of M.Tech degree on securing a minimum of 5.0/10.0 CGPA.
b) In the event of non-completion of project work and/or non-submission of the project report by the end of the fourth semester, the candidate shall re-register by paying the semester fee for the project. In such a case, the candidate will not be permitted to submit the report earlier than three months and not later than six months from the date of registration.

8.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Core Courses, Elective Core Courses, Laboratory Course, Mini Project with Seminar, Internship, Project Work-1 and Project Work-2.

Each Theory and Laboratory course carries credits based on the number of hours / week as follows:

- **Lecture Hours (Theory):** 1 credit per lecture hour per week.
- **Laboratory Hours (Practical):** 1 credit for 2 practical hours, 2 credits for 3 or 4 practical hours per week.
- **Project Work:** 1 credit for 2 hours of project work per week.

8.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Core Courses	3	3
2	Professional Core Elective Courses	3	3
3	Audit Courses	2	0
4	Laboratory Courses	4	2
5	Open Elective Courses	3	3
6	Mini Project with Seminar	2	2
7	Project Work-1 Dissertation	20	10
8	Project Work-2 Dissertation	32	16

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Core Courses (04)+Professional Core Electives (05) + Open Electives (01)	04@3credits + 05 @ 3 credits + 01@3 credits	30
Total Laboratory Courses (03)	04@2credits	08
Mini Project with Seminar(01)	1@2credit	02
Research Methodology and IPR	1@2 credit	02
Project Work-1	1 @10credit	10
Project Work-2	1 @16credits	16
TOTAL CREDITS		**68**

9.0 EVALUATION METHODOLOGY

9.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIE during the semester, marks are awarded by taking average of two sessional examinations.

9.1.1 Semester End Examination (SEE):

The SEE shall be conducted for 70 marks of 3 hours duration. The syllabus for the theory courses shall be divided into FIVE units and each unit carries equal weightage in terms of marks

distribution. The question paper pattern shall be as defined below.Two full questions with 'either' 'or' choice will be drawn from each unit. Each question carries 14 marks. There could be a maximum of three sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

9.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty/teacher handling the course as given in Table 4. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Technical Seminar and Term Paper.

Table 4: Assessment pattern for Theory Courses

COMPONENT	**THEORY**		**TOTAL MARKS**
Type of Assessment	CIE Exam (Sessional)	Technical Seminar and Term Paper	
Max. CIA	25	5	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration, consisting of 5 one mark compulsory questions in part-A and 4 questions in part-B. The student has to answer any 4 questions out of five questions, each carrying 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Technical Seminar and Term Paper:

Two seminar presentations are conducted during I year I semester and II semester. For seminar, a student under the supervision of a concerned faculty member, shall identify a topic in each course and prepare the term paper with overview of topic. The evaluation of Technical seminar and term paper is for maximum of 5 marks. Marks are awarded by taking average of marks scored in two Seminar Evaluations.

9.2 Laboratory Course:

Each lab will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

All the drawing related courses are evaluated in line with lab courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test for 10 marks each in a semester.

9.3 Project work

Normally, the project work should be carried out at Host Institute (Institute of Aeronautical Engineering). However, it can also be carried out in any of the recognized Educational Institutions, National Laboratories, Research Institutions, Industrial Organizations, Service Organizations or Government Organizations with the prior permission from the guide and concerned Head of the Department. A student shall submit the outcome of the project work in the form of a dissertation.

9.3.1 The student shall submit the project work synopsis at the end of III semester for Phase-I of project evaluation. The Phase-I of project work shall be evaluated by Project Review Committee (PRC) at the end of the third semester for a maximum of 100 marks. Head of the Department (HOD) shall constitute a PRC comprising of senior faculty of the specialization, Guide and Head of the Department.

9.3.2 The first phase of project work is to be carried out in IV semester for Phase –II of Project work. The student will be allowed to appear for final viva voce examination at the end of IV semester only if s/he has submitted s/he project work in the form of paper for presentation/ publication in a conference/journal and produce the proof of acceptance of the paper from the organizers/publishers.

9.3.3 The student shall submit the project work in the form of dissertation at least four weeks ahead of the completion of the program. Head of the Department shall constitute an Internal Evaluation Committee (IEC) comprising of the Chairman BOS (PG), HOD and Guide. As per convenes of all meeting for open pre-submission seminar evaluation of the student. If the open pre-submission seminar by a student is not satisfactory, another seminar shall be scheduled within two weeks.

The evaluation of the project work and the marks allotted are as under:

S. No	Project Phases	Mode	Evaluation Committee	Marks
1	Phase - I	Continuous evaluation at the end of III Semester	Guide	30
2		Evaluation at the end of III Semester	Project Review Committee (PRC) comprising of senior faculty of the specialization, guide and HOD.	70
Total (Phase – I)				**100**
3	Phase - II	An open pre-submission seminar by the student	The Internal Evaluation Committee (IEC) comprising of the Chairman, BOS (PG), HOD and guide wherein the HOD convenes its meeting.	30
4		End Semester Examination (An open seminar followed by viva-voce)	The External Evaluation Committee (EEC) comprising of External Examiner, HOD and guide wherein the HOD shall be the chairman of the committee.	70
Total (Phase-II)				**100**

9.3.4 As soon as a student submits his project work, Principal shall appoint the External Examiner among the panel of examiners recommended by the Chairman, BOS (PG).

9.3.5 The Principal shall schedule the End Semester Examination in project work soon after the completion of the study of program and a student can appear for the same provided s/he has

earned successfully all the requisite credits. The student shall produce the dissertation duly certified by the guide and HOD during the Examination.

9.3.6 The project reports of M.Tech students who have not completed their course work successfully will be evaluated in that semester itself and the result sent confidentially to the Controller of Examinations. The results of the project work evaluation will be declared by the Controller of Examinations only after the successful completion of the courses by those students.

10.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

10.1 It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 80% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

10.2 For cases of medical issues, deficiency of attendance in each course to the extent of 15% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the Department if his/her attendance is between 80% to 65% in every course, subjected to submission of medical certificate and other needful documents to the concerned department.

10.3 The basis for the calculation of the attendance shall be the period prescribed by the institute by its calendar of events. For late admission, attendance is reckoned from the date of admission to the program.

10.4 However, in case of a student having less than 65% attendance in any course, s/he shall be detained in the course and in no case such process will be relaxed.

10.5 Students whose shortage of attendance is not condoned in any subject are not eligible to write their semester end examination of that courses and their registration shall stand cancelled.

10.6 A prescribed fee shall be payable towards Condonation of shortage of attendance.

10.7 A candidate shall put in a minimum required attendance at least in three (3) theory courses for getting promoted to next higher class / semester. Otherwise, s/he shall be declared detained and has to repeat semester.

10.8 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, s/he shall not be eligible for readmission into the same class.

11.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

11.1 Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

11.2 Question papers may be moderated for the coverage of syllabus, pattern of questions by Semester End Examination Committee chaired by Head of the Department one day before the commencement of semester end examinations.

11.3 Internal Examiner shall prepare a detailed scheme of valuation.

11.4 The answer papers of semester end examination should be evaluated by the internal examiner immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover before the same papers are kept for second evaluation by external examiner.

11.5 In case of difference is more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and marks awarded by him shall be taken as final.

11.6 HOD shall invite 3-9 external examiners to evaluate all the end semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted involving external examiners.

11.7 Examination Control Committee shall consolidate the marks awarded by internal and external examiners to award grades.

12.0 SCHEME FOR THE AWARD OF GRADE

12.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures:

i. Not less than 40% marks for each theory course in the semester end examination, and

ii. A minimum of 50% marks for each theory course considering both CIA and SEE

12.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Laboratory / Seminar and Technical Writing / Project, if s/he secures

i. Not less than 40% marks for each Laboratory / Seminar / Project course in the semester end examination,

ii. A minimum of 50% marks for each Laboratory / Mini project with Seminar / Project course considering both internal and semester end examination.

12.3 If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

13.0 LETTER GRADES AND GRADE POINTS

13.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10point grading system with the following letter grades as given below:

Range of Marks	Grade Point	Letter Grade
90% and above (≥ 90% , ≤ 100%)	10	S (Superior)
Below 90% but not less than 80% (≥80% , <90%)	9	A+ (Excellent)
Below 80% but not less than 70% (≥70% , <80%)	8	A (Very Good)
Below 70% but not less than 60% (≥60% , <70%)	7	B+ (Good)
Below 60% but not less than 50% (≥ 50% , <60%)	6	B (Average)
Below 50% (< 50%)	0	F (Fail)
Absent	0	AB (Absent)
Authorized Break of Study	0	ABS

13.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: “S”, “A+”, “A”, “B+”, “B”.

13.3 A student obtaining Grade “F” shall be considered Failed and will be required to reappear in the examination.

13.4 "SA" denotes shortage of attendance (as per item 10) and hence prevention from writing Semester End Examination.

13.5 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

14.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student's is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m} (C_j S_j) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and $C_j$is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	S	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

$$Thus,\ SGPA = 139 / 20 = 6.95$$

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0

$$Thus,\ CGPA = \frac{20x6.9 + 22x7.8 + 25x5.6 + 26x6.0}{93} = 6.51$$

16.0 PHOTOCOPY / REVALUATION

A student, who seeks the revaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s) within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the Department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

17.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of M .Tech degree.

17.1 Student shall register and acquire minimum attendance in all courses and secure 68 credits.

17.2 A student who fails to earn 68 credits within four consecutive academic years from the year of his/her admission with a minimum CGPA of 5.0, shall forfeit his/her degree and his/her admission stands cancelled.

18.0 AWARD OF DEGREE

Classification of degree will be as follows:

CGPA ≥ 7.5	CGPA ≥ 6.5 and < 7.5	CGPA ≥ 5.5 and < 6.5	CGPA ≥ 5.0 and < 5.5	CGPA < 5.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

a) In case a student takes more than one attempt in clearing a course, the final marks secured shall be indicated by * mark in the marks memo.

b) All the candidates who register for the semester end examination will be issued grade sheet by the Institute. Apart from the semester wise marks memos, the institute will issue the provisional certificate subject to the fulfillment of all the academic requirements.

19.0 IMPROVEMENT OF GRADE:

A candidate, after becoming eligible for the award of the degree, may reappear for the final examination in any of the theory courses as and when conducted for the purpose of improving the aggregate and the grade. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the degree.

However, this facility shall not be availed of by a candidate who has taken the Original Degree Certificate. Candidates shall not be permitted to reappear either for CIE in any course or for Semester End Examination (SEE) in laboratory courses (including Project Viva-voce) for the purpose of improvement.

20.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student may be asked to leave the institute in the following circumstances:

a) The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

b) The student fails to satisfy the norms of discipline specified by the institute from time to time.

21.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the college / if any case of indiscipline / malpractice is pending against him/her, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

22.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute.

The college shall institute prizes and medals to meritorious students annually on Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

23.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

24.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievances related to the course under consideration.

25.0 TRANSITORY REGULATIONS

25.1 A student who has been detained in any semester of previous regulations for not satisfying the attendance requirements shall be permitted to join in the corresponding semester of this regulation.

25.2 Semester End Examination in each course under the regulations that precede immediately these regulations shall be conducted three times after the conduct of last regular examination under those regulations. Thereafter, the failed students, if any, shall take examination in the equivalent papers of these regulations as suggested by the Chairman, BOS concerned.

26.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

CAD/CAM

COURSE CATALOG – R18

I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BCCB01	Advanced CAD	PCC	Core	3	0	0	3	30	70	100
BCCB02	Mathematical Methods in Engineering	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective - I	PEC	Elective	3	0	0	3	30	70	100
	Professional Core Elective – II	PEC	Elective	3	0	0	3	30	70	100
	Audit Course – I	Audit - I	Audit	2	0	0	0	30	70	100
PRACTICAL										
BCCB09	Computer Aided Design Laboratory	PCC	Core	0	0	4	2	30	70	100
BCCB25	Computational Techniques Laboratory	PCC	Core	0	0	4	2	30	70	100
TOTAL				**14**	**00**	**08**	**16**	**210**	**490**	**700**

II SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination		
				L	T	P		CIA	SEE	Total
THEORY										
BCCB11	Advanced Finite Element Method	PCC	Core	3	0	0	3	30	70	100
BCCB12	Computer Integrated Manufacturing	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective – III	PEC	Elective	3	0	0	3	30	70	100
	Professional Core Elective – IV	PEC	Elective	3	0	0	3	30	70	100
	Audit Course – II	Audit - II	Audit	2	0	0	0	30	70	100
PRACTICAL										
BCCB19	Computer Aided Machining and Robotics Laboratory	PCC	Core	0	0	4	2	30	70	100
BCCB20	Simulation and Analysis Laboratory	PCC	Core	0	0	4	2	30	70	100
BCCB21	Mini Project with Seminar	PCC	Core	0	0	4	2	30	70	100
TOTAL				**14**	**00**	**12**	**18**	**240**	**560**	**800**

III SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BCSB31	Research Methodology and IPR	PCC	Core	2	0	0	2	30	70	100
	Professional Core Elective – V	PEC	Elective	3	0	0	3	30	70	100
	Open Elective	OE	Elective	3	0	0	3	30	70	100
PRACTICAL										
BCCB40	Phase-I Dissertation	Major Project	Core	0	0	20	10	30	70	100
TOTAL				**08**	**00**	**20**	**18**	**120**	**280**	**400**

IV SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
BCCB41	Phase-II Dissertation	Major Project	Core	0	0	32	16	30	70	100
TOTAL				**0**	**0**	**32**	**16**	**30**	**70**	**100**

PROFESSIONAL CORE ELECTIVE COURSES

PROFESSIONAL COREELECTIVE – I

Course Code	Course Title
BCCB03	Advanced Machine Design
BCCB04	Design for Manufacturing and Assembly
BCCB05	Computer Graphics

PROFESSIONAL COREELECTIVE – II

Course Code	Course Title
BCCB06	Mechanics and Manufacturing Methods of Composites
BCCB07	Precision Engineering
BCCB08	Rapid prototype Technologies

PROFESSIONAL CORE ELECTIVE – III

Course Code	Course Title
BCCB13	Experimental stress Analysis
BCCB14	Intelligent Manufacturing Systems
BCCB15	Tribology

PROFESSIONAL CORE ELECTIVE – IV

Course Code	Course Title
BCCB16	Industrial Robotics
BCCB17	Special Manufacturing Process
BCCB18	Optimization Techniques

PROFESSIONAL CORE ELECTIVE – V

Course Code	Course Title
BCCB22	Automation in Manufacturing
BCCB23	Flexible Manufacturing Systems
BCCB24	Design and Fabrication of Composites

OPEN ELECTIVE COURSES

Course Code	Course Title
BCSB25	Business Analytics
BCSB26	Industrial Safety
BCSB27	Operations Research
BCSB28	Cost Management of Engineering Projects
BCSB29	Composite Materials
BCSB30	Waste to Energy

AUDIT COURSES

Course Code	Course Title
BCSB32	English for Research Paper Writing
BCSB33	Disaster Management
BCSB34	Sanskrit for Technical Knowledge
BCSB35	Value Education
BCSB36	Constitution of India
BCSB37	Pedagogy Studies
BCSB38	Stress Management by Yoga
BCSB39	Personality Development through Life Enlightenment Skills

SYLLABUS

(I – III SEMESTERS)

ADVANCED CAD

I SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB01	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The aim of this course is to impart the overview of advanced computer applications or design and manufacturing. The course covers the basics of geometric modeling, surface modeling and solid modeling. This course also deals with creation of synthetic curves and surfaces. It imposes the knowledge of 2D and 3D transformation, data exchange formats and dimensioning and tolerances.

II. COURSE OBJETIVES:

The students will try to learn:

I. The basics, functional areas of CAD and efficient use of CAD software
II. The requirement and parametric representation of Geometric modelling and synthetic curves.
III. The classification of surface entities and surface representation methods.
IV. The 2D and 3D transformations, different types of projections and data exchange formats of files.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Relate uses and Importance of CAD software in Industries for product design and development	Understand
CO2	Apply Geometric modelling representations for various curves to synthetic design method.	Apply
CO3	Develop the knowledge of surface modelling and parametric representation of analytic surfaces for creating part models	Apply
CO4	Develop the parametric representation of solids for different transformations.	Apply
CO5	Explain about the data exchange standards used to translate the data between CAD and other Computer aided technologies.	Understand

IV. SYLLABUS:

UNIT-I	PRINCIPLES OF COMPUTER GRAPHICS	Classes : 09

Principles of computer graphics: Introduction, graphic primitives, point plotting, lines, Bresenham"s circle algorithm, ellipse, transformation in graphics, coordinate systems, view port, 2D and 3D transformation, hidden surface removal, reflection, shading and generation of character.

UNIT-II	CAD TOOLS	Classes : 09

Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, software documentation, efficient use of CAD software; Geometric modeling: Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves hermite cubic splines Bezier curves Bezier splines rational curves.

UNIT-III	SURFACE MODELING	Classes: 09
Mathematical representation surfaces, surface model, surface entities surface representation. Parametric representation of surfaces, plane surface, rule surface, surface of revolution, tabulated cylinder.		
UNIT-IV	**PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES**	**Classes: 09**
Parametric representation of synthetic surfaces: Hermite Bicubic surface, Bezier surface, Bezier Spline surface, COONs surface, Blending surface Sculptured surface, Surface manipulation; Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).		
UNIT-V	**GEOMETRIC MODELLING-3D**	**Classes : 09**
Geometricmodelling-3D: Solid modeling, solid representation, boundary representation (13-rep), Constructive solid geometry (CSG). CAD/CAM exchange: Evaluation of data, exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS and DXF; Design applications: Mechanical tolerances, mass property calculations, finite element modeling and analysis and mechanical assembly; Collaborative engineering: Collaborative design, principles, approaches, tools, design systems.		

Text Books:

1. Ibrhim Zeid, "Mastering CAD/CAM", Tata McGraw Hill, 2nd Edition, 2013.
2. P. N. Rao, "CAD/CAM Principles and Applications", Tata McGraw Hill, 3rd Edition, 2010.
3. M. P. Groover, E. Zimmers, "CAD/ CAM Computer- Aided Design and Manufacturing", Pearson, 1st Edition, 2003.
4. R. Alavala Chennakesava, "CAD/ CAM Concepts and Applications", PHI, 1st Edition, 2013.

Reference Books:

1. Farid Amirouche, "Principles of Computer-Aided Design and Manufacturing, Pearson, 2nd Edition, 2004.
2. P. Radha Krishnan, "CAD/ CAM/ CIM", New Age International, 4th Edition, 2016.
3. Warren. S. Seames, "Computer Numerical Control Concepts and Programming", Delmar Cengage Learning, 4th Edition, 2013

Web References:

1.http://nptel.ac.in/courses/112102101/
2.http://www.journals.elsevier.com/computer-aided-design
3.https://www.elsevier.com/books/surface-modeling-for-cad-cam/choi/978-0-444-88482-41

E-Text Book:

1. http://sbmpme.blogspot.in/2011/01/cad-cam-cim-p-radhakrishnan.html
2. https://www.scribd.com/doc/228624725/cad-cam-text-book-by-P-N-RAO

MATHEMATICAL METHODS IN ENGINEERING

I SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB02	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The course focuses on more advanced Engineering Mathematics topics which provide with the relevant mathematical tools required in the analysis of problems in engineering and scientific professions. The course includes probability theory, discrete and continuous random variables, probability distributions, sampling distribution, testing of hypothesis, ordinary differential equations and partial differential equations. The mathematical skills derived from this course form a necessary base to analytical and design concepts encountered in the program.

II. COURSE OBJECTIVES:

I. The mathematical tools which emphasize in engineering applications.
II. The problems with techniques of advanced linear algebra, ordinary differential equations and multivariable differentiation.
III. The quantitative analysis for solving the complex problems.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Describe probability of discrete and continuous random variables for determining probability distribution, sampling distribution of statistics such as t, F and chi-square.	Apply
CO 2	Make use of hypothesis testing in predicting the significant difference in the sample mean for using in ANOVA techniques**.**	Apply
CO 3	Determine Ordinary linear differential equations for solving nonlinear Ordinary Differential Equations.	Apply
CO 4	Explore the First and second order partial differential equations.	Understand
CO 5	Solve First and second order partial differential equations by using different methods	Apply
CO 6	Apply Different methods for solving partial differential equations.	Apply

IV. SYLLABUS

UNIT-I	INTRODUCTION TO PROBABILITY	Classes : 09

Theory Probability Theory and Sampling Distributions. Basic probability theory along with examples. Standard discrete and continuous distributions like Binomial, Poisson, Normal, Exponential etc. Central Limit Theorem and its significance. Some sampling distributions like X^2, t, F.

UNIT-II	TESTING OF STATISTICAL HYPOTHESIS	Classes : 09

Testing a statistical hypothesis, tests on single sample and two samples concerning means and variances. ANOVA: One – way, Two – way with/without interactions.

UNIT-III	**ORDINARY DIFFERENTIAL EQUATIONS**	**Classes: 09**
Ordinary linear differential equations solvable by direct solution methods; solvable nonlinear Ordinary Differiential Equations'.		
UNIT-IV	**PARTIAL DIFFERENTIAL EQUATIONS AND CONCEPTS IN SOLUTION TO BOUNDARY VALUE PROBLEMS**	**Classes: 09**
First and second order partial differential equations; canonical forms.		
UNIT-V	**MAJOR EQUATION TYPES ENCOUNTERED IN ENGINEERING AND PHYSICAL SCIENCES**	**Classes : 09**
Solution methods for wave equation, D'Alembert solution, potential equation, properties of harmonic functions, maximum principle, solution by variable separation method.		
Text Books:		
1. J. B. Doshi, "Differential Equations for Scientists and Engineers", Narosa, New Delhi. 1st Edition, 2013 2. Douglas C. Montgomery, "Design and Analysis of Experiments" Wiley Student Edition. 7th Edition, 2010.		
Reference Books:		
1. S. P. Gupta, "Statistical Methods", S. Chand & Sons, 37th revised Edition 2010. 2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition, 2009.		

ADVANCED MACHINE DESIGN

I SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB03	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

COURSE OVERVIEW:

The Machine design focus mainly on design of power transmitting elements like gears, connecting rod, crankpin, crankshafts, pistons, cylinders, bearings, belts, ropes, chain's, pulleys, Power screws and nuts. Design basis is strength and stiffness of the parts and selection of material for manufacture of machine elements. Mechanical design is creating new devices or improving existing ones in an attempt to provide the "best" or "optimum "design. In other words, mechanical design may be de need as an iterative decision-making process that has as its objective the creation and optimization of a new or improved mechanical engineering system or device for the fulfillment of a human need or desire, with due regard for conservation of resources and environmental impact.

II. COURSE OBJECTIVES:

The course should enable the students to

I. Apply the systematic engineering design process including, problem definition, information collection, concept generation & selection, and design configuration to design of mechanical systems and elements.
II. Identify and apply applicable theoretical methods of stress and strain determination for mechanical systems and elements under various external and internal loads.
III. Interpret design based on Fatigue & Creep with analytical analysis.
IV. Analyze the stresses produced in circular and non-circular rotating disk and cylinders.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Identify theories of failures for Advanced and Composite Materials	Apply
CO2	Explain the factors affecting fatigue behavior for various materials	Understand
CO3	Develop stress and strain relations for creep phenomenon for components	Apply
CO4	Select Rotating Discs and Rotating Cylinder Discs with uniform thickness for stress development	Apply
CO5	Apply crack propagation theory for circular and non-circular members for life estimation	Apply

IV. SYLLABUS

UNIT-I	GENERAL DESIGN PROCEDURE	Classes : 09

Design Philosophies, DFA, DFM, Reliability, Concurrent Engineering, Aesthetics and Ergonomics, Brief review of principal stresses, Theories of Failure. Advanced Materials, Composite Materials, ceramics and super alloys. Mechanics of Anisotropic materials.

UNIT-II	DESIGN BASED ON FATIGUE	Classes: 09

Design against fatigue, factors affecting fatigue behavior, Theoretical stress concentration factor and notch sensitivity factor. Fatigue under complex stresses, cumulative fatigue design. Linear damage (Miner's Rule), Manson's method.		
UNIT-III	**DESIGN BASED ON CREEP**	**Classes: 09**
True stress and true strain, creep phenomenon, creep parameters, stress relaxation. Designing components subjected to creep.		
UNIT-IV	**ROTATING DISCS AND ROTATING CYLINDER**	**Classes: 09**
Rotating Discs and Rotating Cylinder Discs with uniform thickness. Discs with uniform strength. Stresses in rotating cylinder with and without internal pressures.		
UNIT-V	**DESIGN OF CIRCULAR AND NON-CIRCULAR PLATES & FRACTURE MECHANICS**	**Classes : 09**
Design of Circular and Non-Circular Plates with different loading conditions and supports & Fracture Mechanics: Griffith theory, Concept of SIF and KIC Crack Tip Plasticity. Determination of plastic zone. Size and shape. Fatigue crack propagation and life estimation		
Text Books:		
1. Ali Fatemi, Ralph stephens, "Metal fatigue in Engg. ", John-Wiley and sons publication, 2nd Edition, 2013 2. Brownell & Young, "Process Equipment Design", Wiley, 1st Edition, 2013.		
Reference Books:		
1. Burr & Cheathaam, "Mechanical Analysis & Design", PHI, 2nd Edition, 2013		
2. Joseph E. Shigley, Charles R. Mischke, Richard G. Budynas, "Mechanical Engg. Design", McGraw Hill, 1st Edition, 2013 3. V. V. mahajani, "Joshi, Process Equipment Design", Laxmi Pubications, 1st Edition, 2017. 4. William Orthwin, "Machine Component Design", Jayco Publication, 1st Edition, 2015.		
Web References:		
1. www.nptel.iitm.ac.in		
E-Text Book:		
1. http://elearning.vtu.ac.in/newvtuelc/courses/10ME42B.html		

DESIGN FOR MANUFACTURING AND ASSEMBLY

I SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB04	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The aim of this course is to introduce about the basic design process which based on different aspects of manufacturing as well assembly. Design for manufacturing is an engineering methodology that focuses on reducing time-to-market and total production costs by prioritizing both the ease of manufacture for the product's parts and the simplified assembly of those parts into the final product.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The design of a product and the manufacturing constraints that influence the design of parts and part systems.
II. The general design consideration for machining and casting processes
III. The design guidelines for welding, extrusion process and sheet metalwork.
IV. The development of the assemble process, classification of automatic assembly and design guidelines of manual assembly.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Illustrate the design philosophy, material selection and principles for economical production.	Understand
CO 2	Apply the design recommendations for various manufacturing processes	Apply
CO3	Evaluate the modifications in a design that can be facilitated during welding, forging, extrusion and sheet metal work	Evaluate
CO4	Apply feasible solutions for various product assembly lines	Apply
CO5	Classify for manual assembly requirements for various products workstations	Analyze

IV. SYLLABUS

UNIT-I	INTRODUCTION TO DESIGN	Classes : 09

Introduction: Design philosophy steps in design process, general design rules for manufacturability, basic principles of design Ling for economical production, creativity in design; Materials selection of materials for design developments in material technology, criteria for material selection, material selection interrelationship with process selection process selection charts.

UNIT-II	MACHINING PROCESS	Classes : 09

Machining process: Overview of various machining processes, general design rules for machining, dimensional tolerance and surface roughness, design for machining, ease of redesigning of components for machining ease with suitable examples. General design recommendations for machined parts; Metal casting: Appraisal of various casting processes, selection of casting process, general design considerations for casting, casting tolerances, use of solidification simulation in casting design, product design rules for sand casting.

UNIT-III	METAL JOINING	Classes: 09

Metal joining: Appraisal of various welding processes, factors in design of weldments, general design constitution guidelines, pre and post treatment of welds, effects of thermal stresses in weld joints, design of brazed joints; Forging, design factors for forging, closed dies forging design, parting lines of die drop forging die design general design recommendations.

Extrusion and sheet metal work: Design guidelines for extruded sections, design principles for punching, blanking, bending, deep drawing, Keeler Goodman forming line diagram, component design for blanking.

UNIT-IV	ASSEMBLY ADVANTAGES	Classes: 09

Assembly advantages: Development of the assemble process, choice of assemble method assemble advantages social effects of automation, automatic assembly transfer systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator, paced free, transfer machine

UNIT-V	DESIGN OF MANUAL ASSEMBLY	Classes : 09

Design of manual assembly: Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

Text Books:

1. GeoffreyBoothroyd, "Assembly Automation and Product Design", CRC Press, 2nd Edition, 2013.
2. George E. Deiter, "Engineering Design - Material & Processing Approach", Tata McGraw Hill, 2nd Edition, 2000.
3. Geoffrey Boothroyd, "Hand Book of Product Design", Marcel and Dekken, 1st Edition, 1990.

Reference Books:

1. A Delbainbre, **"**Computer Aided Assembly" 1992.
2. Geoffrey Boothroyd, Peter Dewhurst, Winston. A. Knight, "Product Design for Manufacturing and Assembly", CRC Press, 3rd Edition, 2013.

Web References:

1. http://nptel.ac.in/courses/107103012/
2. http://me.gatech.edu/files/capstone/L071ME4182DFA

E-Text Book:

1. https://books.google.co.in/books/about/Assembly_Automation_and_Product_Design.html?id=XFtgaNFzMHQC
2. https://books.google.co.in/books/about/Product_Design_for_Manufacture_and_Assem.html?id=qYGgjwEACAAJ

COMPUTER GRAPHICS

I SEMSTER: CAD / CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB05	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

One of the best ways to communicate one's idea is through some form of picture or drawing. Computer graphics is the accurate technique that develops the ability to visualize any object with all physical and dimensional configurations. The computer aided drawing assists in preparation of 2D and 3D drawings to carry out sophisticated design and analysis.

II. COURSE COURSE OBJECTIVES:

The students will try to learn

I. The role and basics of Computer Graphics needed for CAD/CAM applications.
II. The geometric entities, projections development of curves and surfaces of Geometrical Modeling.
III. The geometric modeling techniques used in CAD such as wireframe, solid modeling.
IV. The product data standards and structures in computer graphics.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Relate the role of graphic communication in the engineering design process.	Remember
CO2	Explain the concepts and underlying theory of modeling and the usage of models in different engineering applications	Understand
CO3	Develop geometric models in various industrial applications	Apply
CO4	Outline basic concept of image visualization on computer screen.	Understand
CO5	Identify the 2D and 3D transformations and various projections in CAD for synthesis various products	Apply
CO6	Develop parametric and non – parametric equations for curves and surfaces	Apply

IV. SYLLABUS

UNIT-I	INTRODUCTION TO COMPUTER GRAPHICS	Classes : 09

Introduction: Role of computer graphics in CAD/CAM, configuration of graphic workstations, menu design and graphical user interfaces, customization and parametric programming.

UNIT-II	GEOMETRIC TRANSFORMATIONS, PROJECTIONS ANDFUNDAMENTALS OF 2D AND 3D TRANSFORMATIONS	Classes : 09

Geometric transformations and projections: Vector representation of geometric entities, homogeneous coordinate systems; Fundamentals of 2D and 3D transformations: reflection, translation, rotation, scaling, and shearing, various types of projections.

UNIT-III	DEVELOPMENT OF GEOMENTRICAL MODELLING	Classes: 09

Curves: Modeling planar and space curves, analytical and synthetic approaches, non-parametric and parametric equations.

Surfaces: Modeling of bi-parametric freedom surfaces, Coons, Bezier, B-spline, and NURBS surfaces, surface manipulation techniques.

UNIT-IV	GEOMENTRICAL MODELING	Classes: 09

Geometric Modeling: Geometric modeling techniques, wireframe modeling, solid modeling: B Rep CSG, hybrid modelers, feature based, parametric and variation modeling.

UNIT-V	DATA STRUCTURES IN COMPUTER GRAPHICS	Classes: 09

Data Structure in Computer Graphics: Introduction to product data standards and data structures, data-base integration for CIM.

Text Books:

1. D. F. Rogers, J. A. Adams, "Mathematical Elements for Computer Graphics", Tata McGraw Hill, 2nd Edition, 2017.
2. D. Faux, M. J. Pratt, "Computational Geometry for Design and Manufacture", Ellis Horwood, 1st Edition, 2013.
3. Mortenson, M. E., "Geometric Modeling", Industrial Press, 3rd Edition, 2006.
4. Ibrahim Zeid, "CAD/CAM: Theory and Practice", Tata McGraw Hill, 2nd Edition, 2013.
5. B. K. Choi, B. K., "Surface Modeling for CAD/CAM", John Wiley & Sons, 1st Edition, 1991.

Reference Books:

1. C. Pozrikidis, "Introduction to Theoretical and Computational Fluid Dynamics", Oxford University Press, 2nd Edition, 2013.
2. V. Patankar, Hema shavaSuhas , " Numerical Heat Transfer and Fluid Flow", CRC Press, 1st Edition, 2013.

Web References:

1. http://nptel.ac.in/courses/106106090/
2. http://nptel.ac.in/courses/112102101/

E-Text Book:

1. http://www.freebookcentre.net/CompuScience/Free-Computer-Graphics-Books-Download.html
2. https://docs.google.com/file/d/0B_YZ665nBRhlYmNiOTU5ZDItMmU2OC00YTVmLThiNmMtMjg
3. Y2E3ZTgwZDYw/edit?hl=en_US&pref=2&pli=1

MECHANICS AND MANUFACTURING METHODS OF COMPOSITES

I SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB06	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course imparts the science and technology underlying composites manufacturing processes from the perspectives of process selection, materials efficiency, and sustainability. The scope includes constituent materials, manufacturing challenges, defect control strategies, as well as bases for material and process selection and design, and practical issues of producing composite structures

II. COURSE OBJECTIVES:

The students will try to learn:

I. The role of matrix, fiber and filler in the design of polymer/metal matrix composites.
II. The linear elastic properties by rule of mixture, fabrication of composites, mechanical and tribological properties, and fracture behaviour of composite materials.
III. The suitable Fabrication method for different Composite Materials

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Explain the mechanical behavior of layered composites compared to isotropic materials	Understand
CO2	Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro levels.	Apply
CO3	Determine stresses and strains relation in composites materials.	Apply
CO4	Analyses the laminated composite plates for orthotropic plate, cross and angle ply laminated plates using thin plate theory.	Analyze
CO5	Apply advanced manufacturing methods for different composite materials	Apply

IV. SYLLABUS:

UNIT-I	BASIC CONCEPTS AND CHARACTERISTICS	Classes : 09

Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites, Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosets, Metal matrix and ceramic composites.

UNIT-II	MICROMECHANICS	Classes : 09

Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties. Coordinate transformations: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off - axis, stiffness modulus, off - axis compliance.

UNIT-III	ELASTIC BEHAVIOR OF UNIDIRECTIONAL COMPOSITES	Classes: 09
Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations. Strength of unidirectional lamina: Micro mechanics of failure, Failure mechanisms. Strength of an orthotropic lamina, Strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micro mechanical predictions of elastic constants.		
UNIT-IV	**ANALYSIS OF LAMINATED COMPOSITE PLATES**	**Classes: 09**
Introduction, thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.		
UNIT-V	**MANUFACTURING METHODS**	**Classes : 09**
Autoclave, tape production, moulding methods, filament winding, hand layup, pultrusion,RTM		

Text Books:

1. R. M. Jones, "Mechanics of Composite Materials", McGraw Hill Company, New York, 1st Edition1975.
2. Isaac and M.Daniel, "Engineering Mechanics of Composite Materials", Oxford UniversityPress, 2nd Edition, 2013.

Reference Books:

1. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley- Interscience, New York, 3rd Edition, 2013.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1st Edition, 2013.

PRECISION ENGINEERING

I SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB07	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorials Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Precision engineering is involved with the design, manufacturing and measurement of highly specified parts for the medical, aerospace, automotive, oil and gas exploration and related industry. This course has been designed with industry to respond efficiently and effectively to the needs of the Precision Engineering industry.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The importance of accuracy in machine tools, significance of selection of Tolerance & datum features
II. The field of tolerance analysis and geometric tolerances of mechanical products.
III. The importance of operation sequence for typical shaft type of components and preparation of process drawings.
IV. The conceptions of Measurements and working systems of CMM

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Recall the meaning of precision and the importance of employ in industries	Remember
CO2	Outline the principles of various precision engineering processes and apply them in actual field.	Understand
CO3	Illustrate the precision measurements, engineering design process for manufacturing the components	Understand
CO4	Explain the basic concepts of GD and tolerancing based on ASME and ISO standards	Understand
CO5	Summarize the concepts of datums and their classifications.	Understand
CO6	Apply the knowledge of Tolerance analysis of different machining process based on customer expectation	Apply

IV. SYLLABUS

UNIT-I	CONCEPT OF ACCURACYAND TOLERANCE ZONE CONVERSION	Classes: 09

Concepts of accuracy: Introduction, concept of accuracy of machine tools,spindle and displacement accuracies, accuracy of numerical control systems, errors due to numerical interpolation displacement measurement system and velocity lags; geometric dimensioning and tolerancing: Tolerance zone conversions, surfaces, features, features of size, datum features, datum Oddly configured and curved surfaces as datum features, equalizing datums datum feature of representation; form controls, orientation controls logical approach to tolerancing.

UNIT-II	DATUMS	Classes: 09

Datum systems: Design of freedom, grouped datum systems, different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped datum system with spigot and recess pair and tongue, slot pair, computation of transnational and rotational accuracy, geometric analysis and application.

UNIT-III	TOLERANCE ANALYSIS	Classes: 09
Tolerance analysis: Process capability, mean, variance, skewness, Kurtosis, process capability metrics, Cp, Cpk, Cost aspects, feature tolerances. Geometric tolerances; surface finish, review of relationship between attainable tolerance grades and different machining process, cumulative effect of tolerances sure fit law, normal law and truncated normal law.		
UNIT-IV	**TOLERANCE CHARTING TECHNIQUES**	**Classes: 09**
Tolerance charting techniques: Operation sequence for typical shaft type of components, preparation of process drawings for different operations, tolerance worksheets and centrally analysis, examples, design features to facilitate machining; datum features, functional and manufacturing components design, machining considerations, redesign for manufactured.		
UNIT-V	**MEASURING SYSTEM PROCESSING**	**Classes: 09**
In Processing or In-Situ measurement of position of processing, point-post process and on machine measurement of dimensional features and surface-mechanical and optical measuring systems; working systems of CMM; Laser alignment and testing.		

Text Books:

1. R. L. Murthy, "Precision Engineering in Manufacturing", New Age International limited, 1st Edition,1996.
2. James D. Meadows, "Geometric Dimensioning and Tolerancing", Marcel Dekker, 1st Edition, 1995.
3. Norio Taniguchi, "Nano Technology", Oxford University Press, 1st Edition, 1996.
4. Matousek, "Engineering Design–A systematic Approach", Blackie& Son Ltd., London, 1st Edition, 2013.

Reference Books:

1. Preumont, A., "Vibration Control of Active Structures", Kluwer Academic Publishers, 2nd Edition, 2002.
2. F. Y. Cheng, H. Jiang, K. Lou, "Smart Structures: Innovative Systems for Seismic Response Control", CRC Press, 1st Edition, 2008.

Web References:

1.http://nptel.ac.in/courses/112104173/
2.http://ttp.net/978-3-908451-70-9.html
3.http://iopscience.iop.org/journal/0964726

E-Text Books:

1. http://www.me.umn.edu/~wkdurfee/projects/ccefp/fp-chapter/fluid-pwr.pdf
2. http://hydraulicspneumatics.com/ebooks/fluid-power-ebook-fluid-power-basics

RAPID PROTOTYPE TECHNOLOGIES

I SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB08	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course bridges gap between idea and production. Rapid prototyping is a group of methods used to rapidly manufacture a scale model of a physical part or assembly using three-dimensional computer aided design (CAD), Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) data. Construction of the part or assembly is usually done using 3D printing technology. Rapid prototyping techniques are often referred to solid free; computer automated manufacturing, form fabrication. This course covers the knowledge of rapid prototyping systems.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Applying of measurement and scaling technique for prototype manufacturing.
II. Organize the data collection.
III. Identify the application for rapid prototyping.
IV. Application for powder based rapid prototyping systems.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Explain product development, conceptual design and classify rapid prototyping systems; explain stereo lithography process and applications	Understand
CO2	Identify The process photopolymers, photo polymerization, layering technology, laser and laser scanning	Apply
CO3	Apply measurement and scaling technique for prototype manufacturing	Apply
CO4	Identify the Rapid Prototyping Data Formats for Consequence of Building Valid and Invalid Tessellated Models	Apply
CO5	Apply powder based rapid prototyping systems for various Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules.	Apply

IV. SYLLABUS

UNIT-I	INTRODUCTION TO RAPID PROTOTYPING	Classes: 09

Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages and Limitations of Rapid Prototyping, Commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes, Process Chain.

UNIT-II	TYPES OF PROTOTYPING SYSTEMS	Classes: 09

Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. solid ground curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies; solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working

principle, Applications, Advantages and disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT-III	POWDER BASED RAPID PROTOTYPING SYSTEMS AND TOOLING	Classes: 09

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs. RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

UNIT-IV	RAPID PROTOTYPING DATA FORMAT	Classes: 09

Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Rapid Prototyping Software's: Features of various RP software's like Magic's, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor.

UNIT-V	RAPID PROTOTYPING APPLICATIONS	Classes : 09

RP Applications: Application, Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewellery Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules.

Text Books:

1. Chua C.K., Leong K.F, LIM C.S, "Rapid prototyping: Principles and Applications", World Scientific publications, 3rd Edition, 2010.

Reference Books:

1. D.T Pham, S. S. Dony, "Rapid Manufacturing", Springer, 1st Edition, 2001.
2. Paul F Jacobs, "Rapid Prototyping & Manufacturing", Wohlers Associates, 2000 ASME Press, 1st Edition, 1996.

Web References:

1. http://nptel.ac.in/courses/112107077/38
2. http://web.iitd.ac.in/~pmpandey/MEL120_html/RP_document.pdf

E-Text Book:

1. https://books.google.co.in/books?id=4OYcyiDUpsQC&redir_esc=y
2. http://store.elsevier.com/Direct-Write-Technologies-for-Rapid-Prototyping-Applications/isbn- 9780121742317/

COMPUTER AIDED DESIGN LABORATORY

I Semester: CAD / CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB09	Core	0	0	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

I. COURSE OVERVIEW:

Computer aided Design laboratory is a course primary important to mechanical engineering students. The aim is to impart the overview of computer applications or design and manufacturing the discrete engine components, assemblies and final product to meet the global competition. The course covers the basics of geometric modeling, surface modeling and solid modeling. This course also deals with creation of synthetic curves and surfaces. It imposes the knowledge of latest manufacturing techniques using different programming methods, Group Technologies. It makes the student to understand the modern inspection methods and concepts of CAD.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The modern trends in design and manufacturing using CAD.
II. The significance of parametric technology and its application in 2D sketching.
III. The significance of parametric feature-based modeling and its application in 3D machine components modeling.
IV. The concepts of thermal analysis for transient heat transfer condition with different loads.

III. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO1	Select the Parametric Modeling Fundamentals, Procedure, and "Shape before Size" Approaches for Product design	Apply
CO2	Utilize graphics software for various CAD applications	Apply
CO3	Choose importance of CAD in the light of allied technologies such as CAM, CAE and FEA.	Create
CO4	Classify 3D assemblies that represent static and dynamic Mechanical Systems for assembly drawing	Analyze
CO5	Utilization of different inputs using Part model and Assembly of parts	Apply
CO6	Develop the Generation of surfaces and Analysis of Models	Apply

IV. SYLLABUS:

Week-1	**INTRODCUTION TO CAD AND TOOLS: Part -1**

Creation of working drawing, creating geometry, constraining the profile, extracting a part using tools, creating pattern of hole.

Week-2	**INTRODUCTION TO CAD AND TOOLS: Part-2**

Translating Rotating, Mirroring, Managing The Specification Tree. Creating Sheets And Views, Creating Text And Dimensions.

Week-3	**ASSEMBLY OF PART DRAWING :Part -1**
Creating an assembly, moving components, assembling existing components, creating bill of materials	
Week-4	**ASSEMBLY OF PART DRAWING :Part -2**
Creating wire frame and surface geometry using generative shape design and sweep tools.	
Week-5	**GENERATION OF SURFACES :Part -1**
Generation of Ferguson's cubic surface patches, Bezier surface patches	
Week-6	**GENERATION OF SURFACES :Part-2**
Generation of Coon's patch, import and export of drawing from other software.	
Week-7	**ANALYSIS OF MODEL :Part -1**
Linear static analysis :Automatic calculation of rigid body modes using specified Eigen value shift, lumped and consistent mass matrices	
Week-8	**ANALYSIS OF MODEL:Part-2**
Buckling Analysis: Jacobi inverse iteration techniques, steady state harmonic response, and mode superposition method, overall structural and damping. Linear dynamic analysis: Non linear static analysis, Non-linear dynamic analysis. Steady state heat transfer analysis problems.	
Week-9	**THERMAL ANALYSIS :Part -1**
Transient Heat Transfer Analysis: Familiarity with element library, Defining Boundary conditions, multipoint constraint familiarity with different types of loads.	
Week-10	**THERMAL ANALYSIS:Part-2**
Solution techniques, direct and iterative solver. Results and analysis. Design optimization.	

Text Books:

1. Farid Amirouche, "Principles of Computer-Aided Design and Manufacturing, Pearson, 2nd Edition, 2004.
2. P. Radha Krishnan, "CAD/ CAM/ CIM", New Age International, 4th Edition, 2016.
3. Warren. S. Seames, "Computer Numerical Control Concepts and Programming", Delmar Cengage Learning, 4th Edition, 2013.

E-Text Book:

1. http://sbmpme.blogspot.in/2011/01/cad-cam-cim-p-radhakrishnan.html
2. https://www.scribd.com/doc/228624725/cad-cam-text-book-by-P-N-RAO

SOFTWARE AND HARDWARE REQUIRED FOR A BATCH OF 18 STUDETNS

SOFTWARE: AutoCAD 2016, CATIA R2016, ANSYS.

HARDWARE: 500 GB HDD, 4GB RAM.

COMPUTATIONAL TECHNIQUES LABORATORY

I Semester: CAD / CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB25	Core	0	0	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

I. COURSE OVERVIEW:

This course is designed to give an overview of Computational Techniques of interest to engineers. Focus will be on numerical methods, their properties and analysis.

II. COURSE OBJECTIVES:

The students will try to learn

I. The MAT LAB programs for simple and complex engineering problems.
II. The output graphical plots of SF, BM for the given loads and thermal stress analysis of piston using MATLAB programs
III. The MATLAB programs for graphic functions, multi body dynamics and solutions of difference equation using Euler Method
IV. The real time applications such as vibration and acceleration implemented using MATLAB programs.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Develop program and plot the Shear force, bending moment and geometric functions of single and double variables for complex engineering problems	Apply
CO2	Analysis of piston through MATLAB for thermal stresses	Analyze
CO3	Develop formulation of ideal gas equation using MATLAB for thermodynamic relations	Apply
CO4	Develop Euler equation of motion using MATLAB programs to find path movement	Apply
CO5	Apply Simulation for multi body dynamic analysis software for balancing vibration	Apply
CO6	Determination of polynomial equation using method of Least Square Curve Fitting	Evaluate

IV. SYLLABUS:

Week-1	**INTRODUCTION TO MATLAB PROGRAM**

Applications to MATLAB in Mechanical Engineering.

Week-2	**MATLAB PROGRAM TO PLOT THE INTERNAL FORCES, AND BENDING MOMENT.**

The radius of the semicircular member is 25 mm and supported with roller and hinged supports.
The load 300N acting vertically downward at the center and 200 N acting horizontally at the roller support toward left direction.

Write a MATLAB program to plot the internal forces, namely, the axial forces, shearing force and bending moment as functions of α for $0 < \alpha < 90^{o}$.

Week-3	**THERMAL STRESS ANALYSIS OF PISTON USING MATLAB PROGRAM**
Temperature distribution around the given piston dimensions.	
Week-4	**FORMULATION OF IDEAL AND REAL GAS EQUATIONS**
Gas phase thermodynamic equations of state relate the three state variables of temperature, pressure, and volume for a gas. One of the three state variables can be calculated through the equation of state if values for the other two variables are known. For example, the ideal gas law states PV = RT ~ where P : pressure, Pa: V : specific or molar gas volume, m^3 mol R : ideal gas constant, (= 8.314 J/(mol K)) T : absolute temperature, K.	
Week-5	**USING MATLAB PROGRAM PLOT THE FUNCTION OF ONE VARIABLE AND TWO VARIABLE**
Graphing-functions of one variable and two variables	
Week-6	**MULTI BODY DYNAMIC ANALYSIS THROUGH MATLAB PROGRAM**
Use of MATLAB to solve simple problems in vibration, Mechanism Simulation using multi body dynamic software	
Week-7	**MATLAB PROGRAM FOR EULERS EQUATION OF MOTION**
Solution of Difference Equations using Euler Method.	
Week-8	**MATLAB PROGRAM FOR CURVE FITTING.**
Determination of polynomial using method of Least Square Curve Fitting.	
Week-9	**DYNAMIC ANALYSIS USING MATLAB PROGRAM**
Dynamics and vibration analysis	
Week-10	**MATLAB PROGRAM TO PLOT THE RESULTANT ACCELERATION AND THE VARIATION OF ACCELERATION**
A jet plane is going in a parabolic path described by y=0.05x2. At a point in the path, it has a velocity of 200 m/s, which is increasing at the rate of 0.8 m/s2 . Find the resultant acceleration and plot the variation of acceleration as a function of its horizontal position x.	

Text Books:

1. Delores M. Etter, David C. Kuncicky, Holly Moore, "Introduction to MATLAB 7", Pearson Education Inc, 1st Edition, 2009.
2. Rao. V. Dukkipati , "MATLAB for ME Engineers" , New Age Science, 1st Edition, 2008.
3. Agam Kumar Tyagi, "MATLAB and Simulink for Engineers", Oxford University Press 1st Edition, 2012.

Web References:

1. http://www.tutorialspoint.com/matlab/
2. http://in.mathworks.com/products/matlab/?requestedDomain=www.mathworks.com
3. http://www.iare.ac.in

ADVANCED FINITE ELEMENT METHOD

II SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB11	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorials Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The finite element analysis (FEA) is a numerical method widely used for modeling and analyzing structures. This course introduces the mathematical modeling concepts of the Finite Element Method for solving structural, thermal and dynamics problems that are too complicated to be solved by analytical methods.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Properties of Stiffness Matrix derived for various types of loads applied on bars, trusses and beams.
II. The finite element formulations and solve 2-D CST, Isoparametric Elements and, Stress-Strain Analysis for 3D Elements.
III. The Eigenvalues and Eigenvectors for stepped bar and beam, explain nonlinear geometric and material non linearity.
IV. The 2D and 3D finite element plates behavior and Boundary Element Formulation of Electrostatic Problems through Numerical implementation.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Explain the energy principles and weighted residual methods to develop the finite element method governing equation for solving bar and trusses	Understand
CO2	Develop 2D problems using CST elements and 3D problems with tetrahedron elements for analyzing the Plates and shells.	Apply
CO3	Evaluate the natural frequencies and thermal stresses for 2-D problems	Evaluate
CO4	Apply theory of plate bending for non-linear and anisotropic materials using C^0 and C^1 continuity elements	Apply
CO5	Apply finite element method for solving electrostatic problems using boundary value methods	Apply

IV. SYLLABUS:

UNIT-I	FINITE ELEMENT METHODS-A REVIEW	Classes: 09

Governing differential equations of one- and two dimensional problems, Library of one dimensional and two dimensional elements; Gauss Quadrature and isoparametric elements-Stress Calculation and Gauss points-Convergence requirements and Patch test

UNIT-II	BENDING OF PLATES AND SHELLS	Classes: 09

Bending of Plates and Shells – Finite Element Formulation of Plate and Shell Elements – Thin and Thick Plates-Confirming and non-Confirming Elements – C0 and C1 Continuity Elements –Shell elements as degenerate 3D stress elements-Applications.

UNIT-III	THREE DIMENSIONAL SOLIDS	Classes: 09
Introduction - Tetrahedra element - Hexahedron element. Linear and higher order elements -Elements with curved surfaces		
UNIT-IV	**SPECIAL PURPOSE ELEMENTS**	**Classes: 09**
Crack tip elements – Transition elements - Finite strip elements-Strip element methods- Method of infinite domain – nodeless elements		
UNIT-V	**NONLINEAR ANALYSIS**	**Classes: 09**
Introduction to nonlinear analysis- Material Nonlinearity-Plasticity-Creep-Visoplasticity-Nonlinearconstitutive problem in solid mechanics- Various yield considerations-solution procedures direct iteration method, Newton Raphson method and Modified newton raphson method-Application in Any One manufacturing process		

Text Books:

1. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", John Wiley & Sons, Incl.,4th Edition, 2002
2. O.C. Zienkiewicz, R.L. Taylor, J.Z. Zhu, Finite Element Method: Its Basic and fundamentals", Butterworth Heinemann, 6th Edition, 2013.

Reference Books:

1. Bathe K.J. "Finite Element Procedures", Prentice Hall, 3rd Edition, 2006.
2. S.S.Rao, Finite element method in Engineering, Butterworth Heinemann, 12th Edition, 2011.
3. J.N.Reddy, An introduction to nonlinear finite element analysis, Oxford University Press, 4th Edition, 2018.

COMPUTER INTEGRATED MANUFACTURING

II SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB12	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorials Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Computer Integrated Manufacturing is a course primary important to mechanical engineering students. The aim is to impart the overview of computer applications or manufacturing the engine components, assemblies and final product to meet the global competition. This course also deals with creation of synthetic curves and surfaces. It makes the student to understand the modern inspection methods and concepts of CIM.

II. COURSE OBJECTIVES:

The students will try to learn

I. The basic components and functions of CIM and NC systems in manufacturing
II. The requirement of data base management, Software & Hardware interface for CAD/CAM/CIM.
III. The different process layouts, material handling and advances in manufacturing system like: GT and CAPP their applications in industries
IV. The importance of computer aided in quality control and inspection methods

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Demonstrate the importance of CIM and NC motion control systems.	Understand
CO2	Understanding the requirement of CIM Software & Hardware to integrate with required data base management systems	Understand
CO3	Explain the integration of activities into a complete flexible manufacturing system.	Understand
CO4	Apply the Parts coding and classification systems to implement the GT and JIT processes	Apply
CO5	Apply the advanced CAQC techniques for monitoring and control the processes	Apply

IV. SYLLABUS:

UNIT-I	INTRODUCTION TO CIM	Classes: 09

Manufacturing - Types, Manufacturing Systems, CIM Definition, CIM wheel, CIM components, Evolution of CIM, needs of CIM, Benefits of CIM, basic components of NC system, NC motion control system, applications of NC,advantages and disadvantages of NC, computer Numerical control, advantages of CNC, functions of CNC, Direct Numerical Control, components of a DNC system, functions of DNC, advantages of DNC.

UNIT-II	CAD	Classes: 09

Development of computers, CIM Hardware & Software, Data-Manufacturing data, types, sources, Structure of data models, Data base and DBMS requirement, RDBMS, SQL, Computer Aided Design - benefits, Graphic Standards, Interfaces, CAD software, Integration of CAD/CAM/CIM.

UNIT-III	FLEXIBLE MANUFACTURING SYSTEMS	Classes: 09
FMS concept, Components of FMS, FMS Layouts, FMS planning and implementation, Tool Management systems-Tool monitoring, Work holding devices- Modular fixturing, flexible fixturing, flexibility, quantitative analysis of flexibility, application and benefits of FMS, automated material handling system –AGVs, Guidance methods, AS/RS.		
UNIT-IV	**AUTOMATED PROCESS PLANNING**	**Classes: 09**
Group Technology, Part families, Part classification and coding, Production flow analysis, Machine cell design, Applications and Benefits of Group Technology, Structure of a Process Planning, Process Planning function, CAPP - Methods of CAPP, CAD based Process Planning, Inventory management - Materials requirements planning - basics of JIT		
UNIT-V	**MONITORING AND QUALITY CONTROL**	**Classes: 09**
Types of production monitoring system, process control & strategies, direct digital control - Supervisory computer control - computer aided quality control - objectives of CAQC, QC and CIM, contact, non-contact inspection methods,CMM and Flexible Inspection systems. Integration of CAQC with CIM.		

Text Books:

1. Kant Vajpayee. S., "Principles of Computer Integrated Manufacturing", Prentice Hall of India, 1st Edition, 2013.
2. Radhakrishnan. P, Subramanyan. S, "CAD/CAM/CIM", New Age International publishers, 4th Edition, 2018.

Reference Books:

1. Scheer.A.W., 'CIM- Towards the Factory of the Future", Springer - Verlag, 1994.
2. Daniel Hunt.V., 'Computer Integrated Manufacturing Hand Book', Chapman & Hall, 1989.

EXPERIMENTAL STRESS ANALYSIS

II SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB13	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorials Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Experimental methods exploit a particular physical phenomenon to make measurements and hence only certain information that can be recorded by an experimental technique. The course introduces the physical principle used by various experimental techniques and also provides a guideline to select an experimental technique for a given application. The role of analytical, numerical and experimental methods in solving a problem in solid mechanics is discussed. Stress and strain at a point is discussed in most courses on solid mechanics but little attention is paid on the variation of these quantities over the field of the model. Attention is drawn on the richness of whole field information provided by most of the optical techniques.

II. COURSE OBJECTIVES:

The students will try to learn

I. To Study the Various Experimental Techniques Involved for Measuring Displacements, Stresses, Strains in Structural Components.
II. Understand the shear force and bending moment diagrams of symmetrical beams
III. Distinguish bending and shear stresses developed in beams of various sections

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Understand the types of strain gauges, mounting techniques and strain gauge circuits explain the measurement of strain under static and dynamic loads.	Understand
CO2	Apply the Mechanical, optical, pneumatic and electrical strain gauges for strain measurement. Analysis of measuring circuits and strains of different strain gauge rosettes	Apply
CO3	Explain different methods of 2 D photoelasticity along with properties of different materials for strain measurement	Understand
CO4	Identify the different types of coatings, test strain data using brittle coating and birefringent coating	Apply
CO5	Apply the Fundamentals of, Radiography, Thermography, Ultrasonics, Eddy current Testing, Fluorescent Penetrant Testing, Acoustic Emission Techniques for nondestructive testing	Apply

IV. SYLLABUS:

UNIT-I	EXTENSOMETERS AND DISPLACEMENT SENSORS	Classes: 09

Principles of Measurements, Accuracy, Sensitivity and Range of Measurements, Mechanical, Optical, Acoustical and Electrical Extensometers and Their Uses, Advantages and Disadvantages, Capacitance Gauges, Laser Displacement Sensors.

UNIT-II	ELECTRICAL RESISTANCE STRAIN GAUGES	Classes: 09
Principle Of Operation And Requirements, Types And Their Uses, Materials For Strain Gauges, Calibration And Temperature Compensation, Cross Sensitivity, Wheatstone Bridge And Potentiometer Circuits For Static And Dynamic Strain Measurements, Strain Indicators, Rosette Analysis, Stress Gauges, Load Cells, Data Acquisition, Six Component Balance.		
UNIT-III	**PHOTOELASTICITY**	**Classes: 09**
Two Dimensional Photo Elasticity, Photo Elastic Materials, Concept Of Light – Photoelastic Effects, Stress Optic Law, Transmission Photoelasticity, Jones Calculus, Plane And Circular Polariscopes. Interpretation Of Fringe Pattern, Calibration Of Photoelastic Materials, Compensation And Separation Techniques, Introduction To Three Dimensional Photo Elasticity.		
UNIT-IV	**BRITTLE COATING AND MOIRE TECHNIQUES**	**Classes: 09**
Relation Between Stresses In Coating And Specimen, Use of Failure Theories In Brittle Coating, Moire Method Of Strain Analysis		
UNIT-V	**NON – DESTRUCTIVE TESTING**	**Classes: 09**
Fundamentals Of NDT, Acoustic Emission Technique, Radiography, Thermography, Ultrasonics, Eddy Current Testing, Fluorescent Penetrant Testing,		

Text Books:

1. Dally, J.W., And Riley, W.F., "Experimental Stress Analysis", McGraw Hill Inc., 1st Edition, 2013.
2. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., And Ramachandra, K., "Experimental Stress Analysis", Tata McGraw Hill, New Delhi, 1st Edition, 1984.

Reference Books:

1. Hetenyi, M., "Hand Book Of Experimental Stress Analysis", John Wiley And Sons Inc., New York, 1st Edition, 1972.
2. Pollock A.A., Acoustic Emission In Acoustics And Vibration Progress, Ed. Stephens R.W.B., Chapman And Hall, 1st Edition, 1993.

INTELLEGENT MANUFACTURING SYSTEMS

II SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB14	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course will provide students with artificial intelligence (AI) techniques and its application in manufacturing systems. Intelligent Manufacturing System provides a modern manufacturing system with integration of machines, processes, artificial intelligence which integrates the abilities of humans. Manufacturing system refers to the entire process of gathering inputs, arranging, and transforming them into the desired output. It seeks to achieve optimal utilization of manufacturing resources, minimize wastage, and add value to the business.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The statistics and optimization methodologies in intelligent manufacturing systems.
II. The importance of Knowledge based system and Knowledge Acquisition
III. The importance of intelligence in manufacturing systems, so as to apply the artificial intelligence in the application of manufacturing
IV. The modern techniques such as APP and GT used in manufacturing systems

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Outline the systematic approach for design and implementation of manufacturing systems	Understand
CO2	Explain the Components of Knowledge Based Systems and Knowledge representation for Equipment Selection.	Understand
CO3	Apply Artificial intelligence (AI) and Machine Learning techniques to solve the real problems in shop-floor level or capacity planning problems.	Apply
CO4	Make use of various Automated Process Planning approach for problem solving	Apply
CO5	Develop various algorithms to cluster products based on group technology concepts	Apply

IV. SYLLABUS:

UNIT-I	INTRODUCTION TO COMPUTER INTEGRATED MANUFACTURING	Classes: 09

Computer integrated manufacturing systems structure and functional areas of CIM system, CAD, CAPP, CAM, CAQC, ASRS. Advantages of computer aided manufacturing, manufacturing communication systems, MAP/TOP, OSI model, data redundancy, top-down and bottom-up approach, volume of information, intelligent manufacturing system components, system architecture and data flow, system operation.

UNIT-II	KNOWLEDGE BASED SYSTEM	Classes: 09
Components of knowledge based systems, basic components of knowledge based systems, knowledge representation, comparison of knowledge representation schemes, interference engine, knowledge acquisition.		
UNIT-III	**MACHINE LEARNING**	**Classes: 09**
Machine learning, concept of artificial intelligence, conceptual learning. Artificial neural networks, biological neuron, artificial neuron, types of Neural Networks, applications in manufacturing.		
UNIT-IV	**AUTOMATED PROCESS PLANNING AND KNOWLEDGE BASED SYSTEM**	**Classes: 09**
Automated process planning: Variant approach, generative approach, expert systems for process planning, feature recognition, phases of process planning. Knowledge based system for equipment selection, manufacturing system design. equipment selection Problem, modeling the manufacturing equipment selection problem, problem solving approach in KBSES, structure of the KRSES.		
UNIT-V	**GROUP TECHNOLOGY**	**Classes: 09**
Group technology: Models and algorithms visual method, coding Method, cluster analysis method, matrix formation, similarity coefficient method, sorting based algorithms, bond energy algorithm, cost based method, cluster identification method, extended CI Method; Knowledge based group technology, group technology in automated manufacturing system, structure of knowledge based system for group technology (KBSCIT), data Base, knowledge base, clustering algorithm.		

Text Books:

1. Andrew Kusiak, "Intelligent Manufacturing Systems", Prentice Hall, 1st Edition, 1990.
2. Yagna Narayana, "Artificial Neural Networks", PHI, 1st Edition, 2006.
3. M. P. Groover, "Automation, Production Systems and CIM", PHI, 2nd Edition, 2007.
4. Simon Hhaykin, "Neural networks: A comprehensive foundation", PHI, 1st Edition,1994.

Reference Books:

1. B.Yegnanarayana, "Artificial neural networks", PHI, 1st Edition, 2004.
2. Li Min Fu, "Neural networks in Computer intelligence", TMH, 1st Edition, 2003.
3. David M. Skapura, James A. Freeman, "Neural networks", Pearson Education, 1st Edition, 2004.
4. Jacek M. Zurada, "Introduction to Artificial Neural Systems", JAICO Publishing House 1st Edition, 2013.

Web References:

1. http://nptel.ac.in/courses/117105084/
2. http://prolog.univie.ac.at/teaching/LVAs/Layout_und_Design/SS09/Skript%20insel.pdf
3. http://nptel.ac.in/courses/106106139/
4. http://nptel.ac.in/courses/106106126/

E-Text Books:

1. https://books.google.co.in/books/about/Intelligent_manufacturing_systems.html?id=5RVUAAAAM AAJ&hl=en2.https://books.google.co.in/books/about/ARTIFICIAL_NEURAL_NETWORKS.html?id=RTt vUVU_ xL4C
2. https://donvalebooks.com/pdf-automation-production-systems-and-cim-groover-second-edition.html

TRIBOLOGY

II SEMETER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB15	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Design of surfaces in contact is a critical problem for mechanical engineering. This course addresses the design of tribological systems: the interfaces between two or more bodies in relative motion. Fundamental topics include: friction, wear, wear mechanism, wear model, hydrodynamic, hydrostatic and lubrication. It also covers the corrosion, prevention of corrosion and various types of engineering materials.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The basic knowledge about different methods of friction, surface interaction and surface treatment
II. The principles of lubrication, lubrication regimes, theories of hydrodynamic and the advanced lubrication techniques.
III. The principles of Corrosion, factors affecting and prevention of corrosion.
IV. The in - depth knowledge of various engineering materials

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Recall importance of Tribological phenomenon	Remember
CO2	Explain the application of Lubricants as per the requirements.	Understand
CO3	Identify different areas of Industrial Tribology.	Apply
CO4	Explain the friction, different laws of friction and topology of surfaces.	Understand
CO5	Illustrate wear processes, wear theory, behavior of metals and non-metals and different instruments.	Understand
CO6	Outline the properties of lubricants, and their different types like solid, dry and gas lubrication	Understand

IV. SYLLABUS:

UNIT-I	SURFACE INTERACTION AND FRICTION	Classes : 09

Topography of Surfaces, Surface features, properties and measurement, surface interaction, adhesive theory of sliding friction, rolling friction, friction properties of metallic and non-metallic materials, friction in extreme conditions, thermal considerations in sliding contact.

UNIT-II	WEAR AND SURFACE TREATMENT	Classes : 09

Process of wear, mechanism of various types of wear, laws of wear, theoretical wear models, wear of metals and non metals, surface treatments, surface modifications, surface coatings methods, surface topography measurements, laser methods, instrumentation, international standards in friction and wear measurements.

UNIT-III	LUBRICANTS AND LUBRICATION REGIMES	Classes: 09
Lubricants and their physical properties, viscosity and other properties of oils, additives and selection of lubricants, lubricants standards ISO, SAE, AGMA, BIS standards. Lubrication regimes, solid lubrication, dry and marginally lubricated contacts, boundary lubrication hydrodynamic lubrication, elasto and plasto hydrodynamic, magneto hydrodynamic lubrication, hydro static lubrication, gas lubrication.		
UNIT-IV	**CORROSION**	**Classes: 09**
Introduction, principle of corrosion , classification of corrosion, types of corrosion, factors influencing corrosion, testing of corrosion, in-service monitoring, simulated service, laboratory testing, evaluation of corrosion, prevention of corrosion, material selection, alteration of environment, design, cathodic and anodic protection, corrosion inhibitors.		
UNIT-V	**ENGINEERING MATERIALS**	**Classes : 09**
Introduction, advanced alloys, super alloys, titanium alloys, magnesium alloys, aluminium alloys, and nickel based alloys, ceramics, polymers, biomaterials, applications, bio-tribology and nano-tribology.		

Text Books:

1. G.W.Stachowiak, A.W.Batchelor, "Engineering Tribology", Butterworth-Heinemann, UK, 2nd Edition, 2005.
2. Rabinowicz.E, "Friction and Wear of materials", John Willey &Sons, UK, 2013.

Reference Books:

1. S. K. Basu, S. N.Sengupta,B.B.Ahuja ,"Fundamentals of Tribology", Prentice –Hall of India Pvt Ltd, New Delhi, 1st Edition, 2005.
2. Williams J.A. "Engineering Tribology", Oxford Univ. Press, 1st Edition, 1994.

Web References:

1. http://www.tribology-abc.com/
2. https://ocw.mit.edu/courses/mechanical-engineering/2-800-tribology-fall-2004/index.htm

E-Text Book:

1. http://www.asminternational.org/documents/10192/3454476/ACFAA73.pdf/cdfc952b-62aa-477d- 9bb2-3abb823a652d
2. http://as.wiley.com/WileyCDA/WileyTitle/productCd-047063927X.html

INDUSTRIAL ROBOTICS

II SEMESTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB16	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Robotics is to familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, chose, and incorporate robotic technology in engineering systems.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The basics of robot anatomy position, representation and motions control of robot manipulators.
II. The functions of end effectors and various types of grippers used in Industrial Robotics for automation
III. The knowledge and skill on robot programming languages for different robotic tasks.
IV. The robot cell design, and future application of robotics in Industry.

III.COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Recall various robot components and their workspace.	Remember
CO2	Identify various components of robot and select appropriate type of actuator for a joint.	Apply
CO3	Illustrate different sensors, functions of vision systems, and their applications	Understand
CO4	Illustrate the basic concepts associated with the components and sensors of Robots	Understand
CO5	Analyze the forward kinematics, inverse kinematics and Jacobian for serial and parallel robots.	Analyze
CO6	Identify different types of end effectors and grippers required for specific applications.	Apply

IV. SYLLABUS:

UNIT-I	INTRODUCTION TO AUTOMATION AND ROBOTICS	Classes : 09

An over view of robotics, classification by coordinate system and control systems, components of the industrial robotics: Degrees of freedom, end effectors: mechanical gripper, magnetic vacuum cup and other types of grippers , general consideration on gripper selection and design, robot actuator and sensors.

UNIT-II	MOTION ANALYSIS	Classes : 09

Basic rotation matrices, composite rotation matrices, equivalent angle and axis homogeneous transformation, problems; Manipulator kinematics**:** D-H notations, joint coordinates and world coordinates, forward and inverse kinematics, problems.

UNIT-III	DIFFERENTIONAL KINEMATICS	Classes: 09

Differential kinematics: Differential Kinematics of planar and spherical manipulators, jacobians, problems; differential kinematics: Differential Kinematics of planar and spherical manipulators, jacobians, problems.

Robot dynamics: Lagrange, euler formulations, newton-euler formulations, problems on planar two link manipulators.

UNIT-IV	TRAJECTORY PLANNING	Classes: 09
Joint space scheme, cubic polynomial fit, avoidance of obstacles , types of motion: Slew motion, joint interpolated motion, straight line motion, problems, robot actuators and feed back components: actuators: Pneumatic.		
UNIT-V	**ROBOT APPLICATIONS**	**Classes : 09**
Robot Application in Manufacturing**:** Material handling, assembly and inspection, work cell design.		
Text Books:		
1. M. P.Groover, "Industrial Robotics", Pearson, 2nd Edition, 2012. 2. J.J Criag, "Introduction to Robotic Mechanics and Control", Pearson, 3rd Edition, 2013.		
Reference Books:		
1. K.S Fu, "Robotics", McGraw Hill, 1st Edition, 2013. 2.Richard, D.Klafter, Thomas A Chmielewski, MiachaelNeigen, "Robotic Engineering An Integrated Approach", Prentice Hall, 1st Edition, 2013. 3. Asada, Slotine, "Robot Analysis and lntelligence", Wiley, 1st Edition, 2013. 4. Mark W. Spong, M. Vidyasagar, I.John, "Robot Dynamics & Control", John Wiley & Sons, 1st Edition, 2013. 5. R. K. Mittal, I.J. Nagrath, "Robotics and Control", Tata McGraw hill, 1st Edition, 2011.		
Web References:		
1. http://nptel.ac.in/courses/112101099/ 2. http://nptel.ac.in/courses/112101099/3		
E-Text Book:		
1.http://www.intechopen.com/books/robot-control 2.http://www.springer.com/gp/book/97818462864 14		

SPECIAL MANUFACTURING PROCESSES

II SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB17	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The primary objective of this course is to introduce the concept of manufacturing technology with the help of various processes widely employed in industries. This course is designed to provide students with an overview of a wide variety of manufacturing processes. The fundamental principles behind the processes will be discussed with the intent of providing a working knowledge of a broad range of manufacturing processes.

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Understanding the basic surface treatment coating in manufacturing.
II. Applying the advanced aspects in processing of ceramics.
III. Understanding of modern trends in manufacturing fields.

III.COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Understand different methods of cleaning and coating for various materials	Understand
CO2	Identify process for powder preparation using ceramics, reinforced plastics, metal matrix composites, ceramic matrix composites and polymer matrix composites	Apply
CO3	Plan to fabricate microelectronic devices using Crystal growth and wafer preparation, film deposition oxidation, lithography and computer aided design in microelectronics	Apply
CO4	Understand various E manufacturing such as Nano manufacturing techniques and micromachining, high Speed machining and hot machining	Understand
CO5	Build prototype models using rapid prototyping techniques for product development	Create

IV. SYLLABUS:

UNIT-I	SURFACE TREATMENT	Classes: 09

Surface treatment: Scope, cleaners, methods of cleaning, surface coating types, and ceramic and organic methods of coating, economics of coating, electro forming, chemical vapor deposition, thermal spraying, ion implantation, diffusion coating, diamond coating and cladding.

UNIT-II	PROCESSING OF CERAMICS	Classes: 09

Processing of ceramics: Applications, characteristics, classification, processing of particulate ceramics, powder preparations, consolidation, drying, sintering, hot compaction, area of application, finishing of ceramics; Processing of composites: Composite layers, particulate and fiber reinforced composites, elastomers, reinforced plastics, metal matrix composites, ceramic matrix composites, polymer matrix composites.

UNIT-III	FABRICATION OF MICROELECTRONIC DEVICES	Classes: 09
Fabrication of microelectronic devices: Crystal growth and wafer preparation, film deposition oxidation, lithography, bonding and packaging, reliability and yield. Printed Circuit boards, computer aided design in micro electronics, surface mount technology, integrated circuit economics.		
UNIT-IV	**E-MANUFACTURING**	**Classes: 09**
E-manufacturing: Nano manufacturing techniques and micromachining, high Speed machining and hot machining.		
UNIT-V	**RAPID PROTOTYPING**	**Classes: 09**
Rapid prototyping: Working principles, methods, stereo lithography, laser Sintering, fused deposition method, applications and limitations, rapid tooling, techniques of rapid manufacturing		

Text Books:

1. I Kalpakijian, "Manufacturing Engineering and Technology", Adisson Wesley, 7th Edition, 1995.
2. R. A. Lindburg, "Process and Materials of Manufacturing", PHI, 1st Edition, 1990.
3. Rao. R. Thummala, Eugene, J. Rymaszewski,Van Nostrand Renihold, "Microelectronic Packaging Handbook", 1st Edition, 2013.
4. Tai-Run Hsu, "MEMS & Micro Systems Design and manufacture", Tata McGraw Hill, 1st Edition, 2002.

Reference Books:

1. Rao. R. Thummala, Eugene, J. Rymaszewski,Van Nostrand Renihold, "Microelectronic Packaging Handbook", 1st Edition, 2013.
2. Tai-Run Hsu, "MEMS & Micro Systems Design and manufacture", Tata McGraw Hill, 1st Edition, 2002.

Web References:

1. https://www.google.co.in/#q=design+of+mems+and+microsystems+nptel
2. http://www.thelibraryofmanufacturing.com

E-Text Book:

1.http://royalmechanicalbuzz.blogspot.in/2015/04/manufacturing

OPTIMIZATION TECHNIQUES

II Semester: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB18	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Optimization Techniques is a scientific approach to decision making which seeks to determine how best to design and operate a system under conditions requiring allocation of scarce resources. Optimization Technique as a research tool, primarily has a set or collection of algorithms which act as tools for problems solving in chosen application areas. This course has extensive applications in engineering, business and public systems and is also used by manufacturing and service industries to solve their day-to-day problems.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The importance of various methods single variable Non-Linear unconstrained optimization.
II. The effects of direct search and gradient methods in Multi variable Non-Linear unconstrained optimization.
III. The fundamental knowledge of Linear Programming and various algorithms of Integer Programming
IV. The working principle of various Nontraditional Optimization Algorithms.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Make use of classical and numerical optimization techniques for single variable non-linear unconstrained problems.	Apply
CO2	Apply multi variable non-linear unconstrained optimization methods for feasible solutions	Apply
CO3	Identify Simplex method for linear programming and simulation techniques for inventory and queuing models.	Apply
CO4	Design formulation for integer and stochastic programming to generate algorithm-based models	Analyze
CO5	Apply geometric programing techniques for traditional and nontraditional algorithms	Apply

IV. SYLLABUS:

UNIT-I	SINGLE VARIABLE NON-LINEAR UNCONSTRAINED OPTIMIZATION	Classes: 09

Single Variable Non-Linear Unconstrained Optimization: Elimination methods: Uni-Model function-its importance, Fibonacci method, Golden section method. Interpolation methods: Quadratic& Cubic interpolation methods involutes.

UNIT-II	MULTI VARIABLE NON-LINEAR UNCONSTRAINED OPTIMIZATION	Classes: 09
Multi variable non-linear unconstrained optimization: Direct search methods – Uni variant method, Pattern search methods – Powell's, Hook -Jeeves, Rosenbrock search methods. Gradient methods: Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method & variable metric method.		
UNIT-III	**LINEAR PROGRAMMING AND SIMULATION**	**Classes: 09**
Linear Programming – Formulation, Simplex method & Artificial variable optimization techniques: Big M &Two-phase methods. Sensitivity analysis: Changes in the objective coefficients, constants coefficients of the constraints. Addition and deletion of variables, constraints. Simulation – Introduction – Types- steps – applications: inventory & queuing – Advantages and disadvantages		
UNIT-IV	**INTEGER PROGRAMMING AND STOCHASTIC PROGRAMMING**	**Classes: 09**
Integer Programming- Introduction – formulation – Gomory cutting plane algorithm – Zero orone algorithm, branch and bound method; Stochastic Programming: Basic concepts of probability theory, random variables distributions-mean, variance, correlation, co variance, joint probability distribution. Stochastic linear programming: Chance constrained algorithm.		
UNIT-V	**GEOMETRIC PROGRAMMING**	**Classes: 09**
Geometric Programming: Posynomials – Arithmetic - Geometric inequality – unconstrained G.P- constrained G.P(≤ type only) Non Traditional Optimization Algorithms: Genetics Algorithm-Working Principles, Similarities and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing-Working Principle-Simple Problems. Introduction to Particle Swarm Optimization(PSO) (very brief)		

Text Books:

1. S.S.Rao, "Optimization Theory & Applications", New Age International, 2nd Edition, 2013.
2. Kalyanmoy Deb, "Optimization for Engineering Design", PHI, 2nd Edition, 2012.

Reference Books:

1. S.D.Sharma, "Operations Research", TMH, 1st Edition, 2012.
2. H.A.Taha, "Operation Research", TMH, 9th Edition, 2014.
3. R.LRardin, "Optimization in Operations Research, Pearson Education, 2nd Edition, 2013.

Web References:

1. https://nptel.ac.in/

E-Text Books:

1. http://www.ilocis.org
2. http://www.img.teebweb.org
3. http://www.ec.europa.eu
4. http://www.epa.ie
5. http://www.birdi.ctu.edu.vn

COMPUTER AIDED MACHINING AND ROBOTICS LABORATORY

II Semester: **CAD/CAM**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB19	Core	0	0	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

I. COURSE OVERVIEW:

This laboratory will provide the Automation program integrates design and manufacturing to promote the present industrial requirement. This program allows a compressive study in the advances in Computer Aided Manufacturing technologies, Automation and Robotics.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The part programming data generation through CAM software.
II. The APT based NC part programs for turning and Milling operations.
III. The tool path simulation for turning and Milling operation using CAM software.
IV. The programming language and simulation of robots for pick and place

III.COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Develop part programming and sequences of operation of CNC turning machines	Apply
CO 2	Design APT based NC programming and tool path simulation for Milling and turning operations,	Create
CO 3	Generate NC code for profile Milling operations using CAM software.	Create
CO 4	Develop NC code and tool path simulation for profile Milling and Threading operations using CAM software.	Apply
CO 5	Develop program for robotic operations to pick and place the objects	Apply

IV.SYLLABUS:

Week-1	**INTRODUCTION TO COMPUTER AIDED MACHINING**
Planning and selection of sequences of operation, tool setting on machine-practice.	
Week-2	**PART PROGRAM-1**
Practice in part programming and operation of CNC turning machines, sub routines and use of cycles.	
Week-3	**PART PROGRAM-2**
Practice in part program and operation of a machine center, joining and selection of sequence of operation, tool setting on machine	
Week-4	**NUMERICAL CONTROL PROGRAMMING-1**
Generate APT based NC programming and tool simulation for drilling operation.	

Week-5	**NUMERICAL CONTROL PROGRAMMING-2**
Practice in APT based NC programming and tool simulation for facing operation.	
Week-6	**NUMERICAL CONTROL PROGRAMMING-3**
Generate of NC code for profile milling operation using CAM software.	
Week-7	**NUMERICAL CONTROL PROGRAMMING-4**
Tool path simulation for profile milling operation using CAM software.	
Week-8	**NUMERICAL CONTROL PROGRAMMING-5**
Develop NC code and tool path simulation for thread operation using CAM software	
Week-9	**ROBOTICS SIMULATION-1**
Practice of robotic languages	
Week-10	**ROBOTICS SIMULATION-2**
3-D Robot Simulation for operation of pick-place robot.	

Text Books:

1. Farid Amirouche, "Principles of Computer-Aided Design and Manufacturing, Pearson, 2nd Edition, 2004.
2. P. Radha Krishnan, "CAD/ CAM/ CIM", New Age International, 4th Edition, 2016.
3. Warren. S. Seames, "Computer Numerical Control Concepts and Programming", Delmar Cengage Learning, 4th Edition, 2013.

Web References:

1. http://sbmpme.blogspot.in/2011/01/cad-cam-cim-p-radhakrishnan.html
2. https://www.scribd.com/doc/228624725/cad-cam-text-book-by-P-N-RAO

SIMULATION AND ANALYSIS LABORATORY

II Semester: **CAD/CAM**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB20	Core	0	0	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

I. COURSE OVERVIEW:

The simulation and analysis laboratory sessions are focusing on creation of geometry, meshing (Discretization) and the physics applied to thermal systems in order to visualize fluid flow and temperature distribution, solving, and reviewing results. This laboratory also covers the usage of finite element methods and necessary coding techniques in the interpretation of results. The Workbench environment is an intuitive up-front numerical methods analysis tool that is used in conjunction with CAD systems and/or Design Modeler. These simulations are used in performing structural, thermal, and electromagnetic systems in the emerging technologies of interdisciplinary applications such as mechanical, aerospace.

II. COURSE OBJECTIVES:

The students will try to learn

I. The importance of software tools needed to Analyze engineering problems.
II. The basics of MATLAB and solve vibration mechanism simulation using multi body dynamic software
III. The fundamentals of ANSYS and perform different stress analysis.
IV. The conductive and convective heat transfer analysis of 2D component using ANSYS.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Solve the vibration Mechanism problems using multi body dynamic software	Analyze
CO 2	Analyze the Stress developed in plates using ANSYS	Analyze
CO 3	Identify the Stresses in plate with a circular hole, rectangular L bracket and different types of beams using Ansys	Analyze
CO 4	Analyze the Stress of an Axi– symmetric components	Analyze
CO 5	Solve the thermal stress analysis of various 2D components using ANSYS	Apply

IV. SYLLABUS:

Week-1	**MATLAB BASICS: Part -1**
MAT LAB basics, dealing with matrices, Graphing-functions of one variable and two variables	
Week-2	**MATLAB BASICS: Part -2**
Use of MATLAB to solve simple problems in vibration Mechanism Simulation using multi body dynamic software.	
Week-3	**ANSYS BASICS: Part -1**
Introduction to Ansys Basics and usage of basic operation.	

Week-4	**ANSYS BASICS: Part -2**
Generation Stress analysis of a plate with a circular hole.	
Week-5	**STRESS ANALYSIS: Part -1**
Stress analysis of rectangular L bracket	
Week-6	**STRESS ANALYSIS: Part -2**
Stress analysis of beams (Cantilever, Simply supported & Fixed ends)	
Week-7	**AXI- SYMMETRIC STRESS ANALYSIS : Part -1**
Stress analysis of an Axi-symmetric component	
Week-8	**THERMAL ANALYSIS**
Thermal stress analysis of a 2D component	
Week-9	**HEAT TRANFER ANALYSIS: Part -1**
Conductive heat transfer analysis of a 2D component.	
Week-10	**HEAT TRANFER ANALYSIS: Part -2**
Convective heat transfer analysis of a 2D component	

Text Books:

1. W T Thomson, "Theory of Vibrations with Applications", CBS Publishers, Delhi, 3rd Edition, 2002.
2. S S Rao, "Mechanical Vibrations" Addison-Wesley Publishing Co, 5th Edition, 2002.
3. Ashok Kumar Mallik. "Principles of Vibration Control", Affiliated East- West Press., 1st Edition, 2002.

Web References:

1. https://trove.nla.gov.au/work/6919983
2. https://2k9meduettaxila.files.wordpress.com/2012/09/rao-mechanical-vibrations-5th-edition-2k9meduettaxila-wordpress-com.pdf

MINI PROJECT WITH SEMINAR

II Semester: **CAD/CAM**

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB21	Core	-	-	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes:36		

I. COURSE OBJECTIVES:

The student will try to learn:

I. How to identify various engineering problems and reviewing available literature.
II. The different techniques used to analyze the complex structural systems.
III. Work on the solutions given and present solution by using his/her technique applying engineering principles.

II. COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO 1	Analyze data to produce useful information and to draw conclusions by systematic deduction.	Analyze
CO 2	Estimate significant individualized interactions between faculty members and students through a multi-term research experience.	Evaluate
CO 3	Plan and implement an investigative or developmental project given general objectives and guidelines.	Apply
CO 4	Organize In-depth skill to use some laboratory, modern tools and techniques	Apply
CO 5	Identify results, concepts, analyses and ideas in written and oral form	Apply
CO 6	Discuss independent investigation that results in the production of a research thesis.	Create

Guidelines to be followed

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.'

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

RESEARCH METHODOLOGY AND IPR

III Semester: CSE, ES, CAD/CAM, AE, ST, PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB31	Core	2	-	-	2	30	70	100
Contact Classes: 30	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 30		

I. COURSE OVERVIEW:

This course imparts research methodology and philosophy of intellectual property rights, including basic concepts employed in quantitative and qualitative research methods, Patents, Copyrights, and Trademarks. It provides the research framework, research methodology research design, and formulation hypothesis, sampling techniques, data analysis and report writing. It implies on research skills and intellectual property rights to encourage new creations, including technology, artwork, and inventions, that might increase economic growth.

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Understand research problem formulation.
II. Analyze research related information.
III. Follow research ethics.
IV. Understand that today's world is controlled by Computer, Information Technology; but tomorrow world will be ruled by ideas, concept, and creativity.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Interpret the technique of determining a research problem for a crucial part of the research study.	Remember
CO2	Examine the way of methods for avoiding plagiarism in research.	Apply
CO3	Apply the feasibility and practicality of research methodology for a proposed project.	Apply
CO4	Make use of the legal procedure and document for claiming patent of invention.	Understand
CO5	Identify different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP.	Understand
CO6	Defend the intellectual property rights throughout the world with the involvement of world intellectual property organization	Apply

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 07

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.
Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II	**RESEARCH ETHICS**	**Classes: 05**
Effective literature studies approaches, analysis Plagiarism, Research ethics.		
UNIT-III	**RESEARCH PROPOSAL**	**Classes: 06**
Effective technical writing, how to write report, Paper Developing a Research Proposal. Format of research proposal, a presentation and assessment by a review committee		
UNIT-IV	**PATENTING**	**Classes: 06**
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.		
UNIT-V	**PATENT RIGHTS**	**Classes: 06**
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.		
Text Books:		
1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'" 2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" 3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"		
Reference Books:		
1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007. 2. Mayall, "Industrial Design", McGraw Hill, 1992. 3. Niebel, "Product Design", McGraw Hill, 1974. 4. Asimov, "Introduction to Design", Prentice Hall, 1962.		
Web References:		
1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016 2. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008		
E-Text Books:		
1. http://nptel.ac.in/courses/107108011/		

AUTOMATION IN MANUFACTURING

III SEMESTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB22	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course imparts the principle of automation and various equipment and systems that are used in the industry. In addition to that, we will be studying the fundamentals of mechatronic system and we will learn how to apply them in practice to develop automated systems.

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Understand of modern trends in automation and manufacturing
II. Application of material handling systems and storage systems.
III. Design of automated assembly lines with quality control.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Apply the automation principles for different automated process control manufacturing units	Apply
CO2	Make use of different material handling technologies for analysis storage systems	Apply
CO3	Identify different manufacturing systems for automated production lines to assembly different components	Apply
CO4	Develop assembly algorithms for application in cellular manufacturing and group technology	Apply
CO5	Apply the advanced CAQC techniques for monitoring and control the processes	Apply

IV. SYLLABUS:

UNIT-I	OVER VIEW OF MANUFACTURING AND AUTOMATION	Classes: 09

Over view of manufacturing and automation: production systems, automation in production systems, automation principles and strategies, manufacturing operations, production facilities, basic elements of an automated system, levels of automation; hardware components for automation and process control, programmable logic controllers and personal computers.

UNIT-II	MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES	Classes: 09

Material handling and identification technologies: Material handling, equipment, analysis storage systems, performance and location strategies, automated storage systems, AS/RS, types, automatic identification methods, barcode technology, RFID.

UNIT-III	MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES	Classes: 09
Manufacturing systems and automated production lines: Manufacturing systems: components of a manufacturing system, Single station manufacturing cells. Manual Assembly lines, line balancing Algorithms, mixed model assembly lines, alternative assembly systems. Automated production lines, Applications, Analysis of transfer lines.		
UNIT-IV	**AUTOMATED ASSEMBLY SYSTEMS**	**Classes: 09**
Automated assembly systems: Fundamentals, Analysis of Assembly systems. Cellular manufacturing, part families, cooling, production flow analysis. Group Technology and flexible Manufacturing systems, Quantitative Analysis.		
UNIT-V	**QUALITY CONTROL AND SUPPORT SYSTEMS**	**Classes: 09**
Quality control and support systems: Quality in Design and manufacturing, inspection principles and strategies, Automated inspection, contact Vs non contact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.		

Text Books:

1. Mikell. P Groover, "Automation, Production system and computer integrated manufacturing", PHI, 3rd Edition, 2012.
2. MikeJ P. Groover, "Automation, Production Systems and CIM", PHI, 1st Edition, 2001.
3. P. Radha Krishnan, S. Subrahamanyan, "CAD/CAM/CIM", New Age International, 1st Edition, 2005.

Reference Books:

1. Sadhu Singh, "Svstem Approach to Computer Integrated Design and Manufacturing", John wiley, 1st Edition, 1996.
2. Tien-Chien Chang, Richard A. Wysk, Hsu-Pin Wang, "Computer Aided Manufacturing", Pearson, 1st Edition, 2009.
3. R Thomas Wright and Michael Berkeihiser, Good Heart, "Manufacturing and Automation Technology, Willcox Publishers, 1st Edition, 2012.

Web References:

1. https://www3.nd.edu/~manufact/MPEM_pdf_files/Ch14.pdf
2. http://www.journals.elsevier.com/journal-of-manufacturing-systems

E-Text Books:

1.http://www.automationmag.com/education/news/4721
2 http://www.e-booksdirectory.com/details.php?ebook=1120

FLEXIBLE MANUFACTURING SYSTEMS

III Semester: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB23	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorials Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

Flexible Manufacturing is a sub discipline of mechanical engineering, and optical engineering concerned with designing machines, fixtures, and other structures that have exceptionally low tolerances, are repeatable, and are stable over time. These approaches have applications in machine tools. allowed a different approach to engine design. The reduced cost of machining has made possible integrated structural configurations, with more functions assigned to the same piece of metal.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The modern trends in design and manufacturing using CAD/CAM.
II. The performance analysis techniques.
III. The preventive maintenance procedures in manufacturing.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Make use of various manufacturing methods available such as the Special Manufacturing System, Manufacturing Cell, and Flexible Manufacturing System for Production process	Apply
CO2	Explain the fundamentals of computer assisted numerical control programming and programming languages for Scheduling	Understand
CO3	Identify the modelling, design and simulation of complex systems for Continuous and discrete mathematical modeling methods	Apply
CO4	Plan Performance Analysis, Transient analysis for manufacturing systems	Apply
CO5	Develop Preventive maintenance for flexible manufacturing systems using Kanban Methodology	Apply

IV. SYLLABUS:

UNIT-I	FLEXIBLE MANUFACTURING SYSTEMS:	Classes: 09

Introduction: Definitions of manufacturing with input-output model, definition of system, basic problems concerning systems and system design procedure, modes of manufacturing – job/batch/flow and multi-product, small batch manufacturing

UNIT-II	SYSTEM MODELING ISSUES	Classes: 09

System modeling issues: Centralized versus distributed control; Real-time vs discrete event control; Forward vs. backward scheduling approaches with finite/infinite capacity loading; Modeling of absorbing states and deadlocks; Conflicts; Concurrency, and synchronization.

UNIT-III	SYSTEM MODELING TOOLS AND TECHNIQUES	Classes: 09
System Modeling Tools and Techniques: Introduction to mathematical modeling, optimization, and simulation; issues related with deterministic and stochastic models. Continuous and discrete mathematical modeling methods -discrete event, monte carlo method; Basic concepts of Markov chains and processes; The M/M/1 and M/M/m queue; Models of manufacturing systems including transfer lines and flexible manufacturing systems, introduction to Petri nets.		
UNIT-IV	**PERFORMANCE ANALYSIS**	**Classes: 09**
Performance Analysis: Transient analysis of manufacturing systems, analysis.		
UNIT-V	**PREVENTIVE MAINTAINANCE**	**Classes: 09**
Preventive maintenance, Karban system, implementation issues.		

Text Books:

1. N. K. Jha, "Hand Book of Flexible Manufacturing Systems", Academic Press, 1st Edition,2013.
2. Talichi Ohno, "Production System beyond Large Scale Production", Toyota Productivity Press India Pvt.Ltd, 1st Edition, 2010.
3. H K Shivanand, "Flexible Manufacturing Systems", New Age International, 1st Edition, 2006.

Reference Books:

1. Farid Amirouche, "Principles of Computer-Aided Design and Manufacturing, 2nd Edition, 2004.
2. P. Radha Krishnan, "CAD/ CAM/ CIM", New Age International, 4th Edition, 2016.

Web Reference:

1. http://www.ignou.ac.in/upload/UNIT6-55.pdf
2. http://www.journals.elsevier.com/computer-aided-design
3. https://www.elsevier.com/books/surface-modeling-for-cad-cam/choi/978-0-444-88482-4

E-Text Books:

1. http://engineeringstudymaterial.net/ebook/flexible-manufacturing-system/
2. http://www.sciencedirect.com/science/book/9780123853103

DESIGN AND FABRICATION OF COMPOSITES

III SEMSTER: CAD/CAM

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCCB24	Elective	3	0	0	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSEOVERVIEW:

This course focuses on the design and manufacture of fibre reinforced composites. The emphasis is on a practical exploration. The course covers the basic make up of composites (fibres and matrices), mould construction, and the design and fabrication of composite parts and structures. Composite manufacturing processes, including basic wet layup and advanced methods such as vacuum bagging and prepreg moulding are addressed in detail. Skills are taught, practiced and assessed in an experiential learning mode.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Understand the role of matrix, fiber and filler in the design of polymer/metal matrix composites.
II. Elucidate linear elastic properties by rule of mixture, fabrication of composites, mechanical and tribological properties, and fracture behavior of composite materials.
III. Assortment of suitable Fabrication method for different Composite Materials
IV. Categorize alternatives involved in the design of composites.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Explain the characteristics and selection of reinforcements for matrix materials	Understand
CO2	Identify the Biaxial strength theories for various composite materials	Apply
CO3	Make use of the stress strain relation for lamina and laminates in industrial applications	Apply
CO4	Select appropriate fabrication method for composite materials	Apply
CO5	Apply the fabrication processes and applications of Metal matrix composite	Apply

IV. SYLLABUS

UNIT-I	**INTRODUCTION TO COMPOSITE MATERIALS**	**Classes: 09**

Introduction to composite materials: Definition, classification, types of matrices material and reinforcements, characteristics and selection, fiber composites, laminated composites, particulate composite, pre-pegs, and sandwich construction.

UNIT-II	**MICRO MECHANICAL ANALYSIS OF LAMINA AND BIAXIAL STRENGTH THEORIES**	**Classes: 09**

Micro mechanical analysis of a lamina: Introduction, Evaluation of the four elastic moduli, rule of mixture, numerical problems; Biaxial strength theories: Maximum stress theory, maximum strain theory, Tsa Hill theory, Tsai, Wutensor theory, numerical problems.

UNIT-III	MACRO MECHANICAL ANALYSIS OF LAMINA AND LAMINATE	Classes:09
Macro mechanics of a lamina: Hooke's law for different types of materials, Number of elastic constants, derivation of nine independent constants for orthotropic material, two dimensional relationships of compliance and stiffness matrix. Hooke's law for two-dimensional angle lamina, engineering constants, numerical problems, Invariant properties, stress strain relations for lamina of arbitrary orientation, numerical problems. Macro mechanical analysis of laminate: Introduction, code, Kirchoff hypothesis, CLT, A, B, and D matrices (Detailed derivation) engineering constants, special cases of laminates, numerical problems.		
UNIT-IV	**MANUFACTURING PROCESS OF COMPOSITES**	**Classes: 09**
Manufacturing: Layup and curing open and closed mould processing, hand layup techniques, bag moulding and filament winding, putrusion, pulforming, thermoforming, Injection moulding, cutting, machining and joining, tooling, quality assurance, introduction, material qualification, types of defects, NDT methods.		
UNIT-V	**METAL MATRIX COMPOSITES AND ITS APPLICATION DEVELOPMENTS**	**Classes: 09**
Metal Matrix Composites: Reinforcement materials, types, fabrication, characteristics and selection, base metals selection, applications; Application developments: aircrafts, missiles, space hardware, automobile, electrical and electronics, marine, recreational and sports equipment, future potential of composites.		

Text Books:

1. Autar K. Kaw, "Mechanics of composite materials", CRC Press, 2nd Edition, 2005.
2. Mein Schwartz, "Composite Materials Handbook", McGraw-Hill, 2nd Edition, 2013.

BUSINESS ANALYTICS

Open Electives

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB25	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course covers the fundamentals of data analysis, such as data gathering or data mining this course covers concepts of data analysis, regression analysis, organization structures, forecasting techniques and decision analysis. The *data analytics* tools help in the data mining processes from loading to transformation, aggregation, automated parameter, and process optimization.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The role of business analytics within an organization.
II. The relationships between the underlying business processes of an organization.
III. To gain an understanding of how managers use business analytics to formulate

III COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1	Analyze data using statistical and business analytics technology	Analyze
CO2	Solve business problems and to support managerial decision making	Apply
CO3	Choose business decision Strategies with the without outcome probabilities	Apply
CO4	Perform statistical analysis on variety of data	Apply
CO5	Experiment Data using Business Analytics Technology	Apply

UNIT-I	BUSINESS ANALYTICS	Classes: 09

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

UNIT-II	REGRESSION ANALYSIS	Classes: 09

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT-III	ORGANIZATION STRUCTURES	Classes: 09

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

UNIT-IV	FORCASTING TECHNIQUES	Classes: 09
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.		
UNIT-V	**DECISION ANALYSIS**	**Classes: 09**
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.		
Text Books		
1. James Evans, "Business Analytics", Persons Education.		
Reference Books		
1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications", Pearson FT Press.		
Web References		
1. http://nptel.ac.in/courses/110107092/		
E-Text Books		
1. http://nptel.ac.in/downloads/110107092/		

INDUSTRIAL SAFETY

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB26	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

In this course, students develop a comprehensive understanding of industrial safety principles and practices. They are equipped with the skills to identify, assess, and manage workplace hazards, promoting a culture of safety in their future engineering careers.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Ensuring duty holders apply inherent safety principles in managing risks.
II. Prioritizing interventions based on the inherent hazards of the site and/or pipeline, performance of duty holders in controlling risks and other defined operational intelligence.
III. Identifying the underlying, as well as the immediate, causes of any deficiencies in duty holders arrangements for managing risks.
IV. Taking action to ensure immediate and underlying causes of failures of risk management are addressed.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Describe the theories of accident causation and preventive measures of industrial accidents.	Understand
CO 2	Summarize the functions of maintenance department and application tools used for maintenance	Understand
CO 3	Recall the corrosion and its prevention methods	Remember
CO 4	Outline the fault tracing methods of various types of equipment	Understand
CO 5	Explain the Periodic and preventive maintenance of mechanical and electrical equipment	Understand

IV. SYLLABUS

UNIT-I	INDUSTRIAL SAFTEY	Classes: 09

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II	MAINTENANCE ENGINEERING	Classes: 09

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III	CORROSION AND PREVENTION TECHNIQUES	Classes: 09

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants- types and applications, Lubrication methods, general sketch, working and applications, i.e. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication.

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT-IV	FAULT TRACING	Classes: 09
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.		
UNIT-V	**PERODIC AND PREVENTIVE MAINTENANCE**	**Classes: 09**
Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.		
Text Books		
1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services. H. P. Garg, "Maintenance Engineering", S. Chand and Company.		
Reference Books		
1. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London.		
Web References		
1. https://onlinecourses.nptel.ac.in/noc18_mg42/preview		
E-Text Books		
1. http://portal.unimap.edu.my/portal/page/portal30/Lecturer%20Notes/KEJURUTERAAN_KOMPUTER/Semester%201%20Sidang%20Akademik%2020142015/DPT333%20Industrial%20safety%20and%20health/Chapter%201%20-%20Introduction%20-Zaizu_0.pdf		

OPERATIONS RESEARCH

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB27	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

The course allow students to possess a solid understanding of optimization techniques and their applications. They are equipped with the skills to formulate and solve optimization problems, analyze and interpret results, and make optimal decisions in various domains such as operations management, logistics, finance, and engineering.

II. COURES OBJECTIVES:

The students will try to learn:

I. Apply the dynamic programming to solve problems of discreet and continuous variables.
II. Understand the concept of nonlinear programming.
III. Describe the sensitivity analysis.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Recall the basics of operation research	Understand
CO2	Explain the characteristics and scope of OR	Understand
CO3	Outline and formulate mathematical problems	Understand
CO4	Select optimal problems solving techniques for a given problem using LP	Apply
CO5	Solve transportation, travelling sales man and Assignment problems	Apply

IV. SYLLABUS:

UNIT-I	**INTRODUCTION**	**Classes: 09**
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models		
UNIT-II	**FORMULATION TECHNIQUES**	**Classes: 09**
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.		
UNIT-III	**NON LINEAR METHODS**	**Classes: 09**
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem. max flow problem - CPM/PERT.		
UNIT-IV	**SCHEDULING MODELS**	**Classes: 09**
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.		
UNIT-V	**DYNAMIC PROGRAMMING AND GAME THEORY**	**Classes: 09**
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation		

Text Books
1. H.A. Taha, “Operations Research - An Introduction”, PHI, 2008 2. H.M. Wagner, “Principles of Operations Research”, PHI, Delhi, 1982. 3. J.C. Pant, “Introduction to Optimisation: Operations Research”, Jain Brothers, Delhi, 2008
Reference Books
1. Hitler Libermann,“Operations Research” McGraw Hill Publications, 2009. 2. Pannerselvam, “Operations Research” Prentice Hall of India, 2010. 3. Harvey M Wagner, “Principles of Operations Research” Prentice Hall of India, 2010.
Web References
1. https://onlinecourses.nptel.ac.in/noc17_mg10/preview
E-Text Books
1. http://nptel.ac.in/courses/112106134/

COST MANAGEMENT OF ENGINEERING PROJECTS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB28	Open Elective	3	-	-	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

I. COURSE OVERVIEW:

The course allow students to have a comprehensive understanding of cost management principles and practices in engineering projects. They are equipped with the skills to plan, estimate, control, and communicate project costs effectively, contributing to the successful delivery of projects within budgetary constraints

II. COUSRE OBJECTIVES:

The students will try to learn:

I. Establish systems to help streamline the transactions between corporate support departments and the operating units.
II. Devise transfer pricing systems to coordinate the buyer-supplier interactions between decentralized organizational operating units
III. Use pseudo profit centers to create profit maximizing behavior in what were formerly cost centers.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Summarize the concept of strategic cost management, strategic cost analysis – target costing, life cycle costing and Kaizen costing and the cost drive concept.	Understand
CO 2	Describe the decision-making; relevant cost, differential cost, incremental cost and opportunity cost, objectives of a costing system.	Understand
CO 3	Interpret the meaning and different types of project management and project execution, detailed engineering activities.	Understand
CO 4	Understand the project contracts, cost behavior and profit planning types and contents, Bar charts and Network diagram	Understand
CO 5	Analyze by using quantitative techniques for cost management like PERT/CPM.	Analyze

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 09
Introduction and Overview of the Strategic Cost Management Process		
UNIT-II	**COST CONCEPTS**	**Classes: 09**
Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and OpportUNITy cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.		
UNIT-III	**PROJECT MANAGEMENT**	**Classes: 09**
Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents. Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.		

UNIT-IV	COST BEHAVIOR AND PROFIT PLANNING	Classes: 09
Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement, Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.		
UNIT-V	**QUANTITATIVE TECHNIQUES**	**Classes: 09**
Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation Problems, Assignment problems, Simulation, Learning Curve Theory.		

Text Books

1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting.
2. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Reference Books

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi.
2. Charles T. Horngren and George Foster, Advanced Management Accounting.
3. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher.

Web References

1. https://onlinecourses.nptel.ac.in/noc16_ce02/preview

E-Text Books

1. http://nptel.ac.in/downloads/110101003/

COMPOSITE MATERIALS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB29	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

In this course, students will gain insight into the manufacturing processes for composites, from choosing appropriate reinforcement fibers to integrating them with suitable matrices. They will develop an understanding of the challenges and considerations involved in achieving desired strength properties. This knowledge will enable them to evaluate and optimize the manufacturing processes for different types of composites based on specific application requirements.

II. COUSE OBJECTIVES:

The students will try to learn:

I. The manufacturing processes of reinforcement fibers and matrices for composites.
II. The concept of tailored design philosophy.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Identify the basic mechanical behavior of composite materials and make sound prediction on the likely behavior of new combinations of materials.	Understand
CO 2	Explain the properties of and applications of fibers, particle reinforcements and make use of rule of mixtures	Understand
CO 3	Interpret Manufacturing of Metal Matrix Composites, Properties and applications.	Understand
CO 4	Understand Manufacturing of polymer Matrix Composites, Properties and applications	Understand
CO 5	Recall the concepts of failure criteria of strength	Remember

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 09

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT-II	REINFORCEMENTS	Classes: 09

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT-III	MANUFACTURING OF METAL MATRIX COMPOSITES	Classes: 09

Casting, Solid State diffusion technique, Cladding, Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites.

Liquid Metal Infiltration, Liquid phase sintering. Manufacturing of Carbon, Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT-IV	MANUFACTURING OF POLYMER MATRIX COMPOSITES	Classes: 09
Preparation of Moulding compounds and prepregs, hand layup method, Autoclave method, Filament winding method, Compression moulding, Reaction injection moulding. Properties and applications.		
UNIT-V	**STRENGTH**	**Classes: 09**
Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.		
Text Books:		
1. R.W.Cahn, "Material Science and Technology" VCH, West Germany. 2. WD Callister, Jr., Adapted by R. Balasubramaniam, "Materials Science and Engineering, An introduction", John Wiley & Sons, NY, Indian edition, 2007.		
Reference Books:		
1. ed-Lubin, "Hand Book of Composite Materials" 2. Deborah D.L. Chung, "Composite Materials Science and Applications" 3. Danial Gay, Suong V. Hoa, and Stephen W. Tasi, "Composite Materials Design and Applications"		
Web References:		
1. https://freevideolectures.com/course/3479/processing-of-non-metals/5		
E-Text Books:		
1. https://www.asminternational.org/documents/10192/1849770/05287G_Sample_Chapter.pdf		

WASTE TO ENERGY

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB30	Open Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

In this course, students will gain insights into the principles associated with effective energy management using biomass resources. They will understand the different conversion technologies and their applications in sustainable energy systems. By applying these principles in their daily lives, students will be able to make informed decisions regarding energy consumption, resource utilization, and environmental sustainability.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The principles associated with effective energy management and to apply these principles in the day to day life.
II. The collection, transfer and transport of municipal solid waste.
III. The design and operation of a municipal solid wasteland fill.
IV. The key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Identify the different sources and types of solid waste by the properties of municipal solid waste for segregation and collection of waste.	Remember
CO 2	Explain the energy generation technologies from waste treatment plants and disposal of solid waste by aerobic composting and incineration process.	Understand
CO 3	Illustrate the classification, preliminary design considerations of landfill and methods of landfill disposal of solid to control greenhouse gases.	Analyze
CO 4	Understand the Composition, characteristics of leachate to control the emission of gases by monitoring the movement of landfill leachate.	Understand
CO 5	Outline the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste.	Create

IV. SYLLABUS:

UNIT-I	**INTRODUCTION TO ENERGY FROM WASTE**	**Classes: 09**

Introduction to Energy from Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste. MSW, Conversion devices. Incinerators, gasifiers, digestors

UNIT-II	**BIOMASS PYROLYSIS**	**Classes: 09**

Biomass Pyrolysis: Pyrolysis, Types, slow fast, Manufacture of charcoal, Methods, Yields and application, Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III	**BIOMASS GASIFICATION**	**Classes: 09**

Gasifiers, Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation. Gasifier burner arrangement for thermal heating.

Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV	BIOMASS COMBUSTION	Classes: 09
Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.		
UNIT-V	**BIOGAS**	**Classes: 09**
Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system. Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion. Types of biogas Plants, Applications. Alcohol production from biomass, Bio diesel production. Urban waste to energy conversion, Biomass energy programme in India.		
Text Books:		
1. Desai, Ashok V, "Non Conventional Energy", Wiley Eastern Ltd., 1990.		
Reference Books:		
1. Khandelwal, K. C. and Mahdi, S. S, "Biogas Technology - A Practical Hand Book", Vol. I & II Tata McGraw Hill Publishing Co. Ltd., 1983. 2. Challal, D. S, "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.		
Web References:		
1. http://nptel.ac.in/courses/103107125/		
E-Text Books:		
1. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996..		

ENGLISH FOR RESEARCH PAPER WRITING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB32	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course, students will be equipped with the necessary tools to effectively communicate their research findings in a scholarly manner. They will develop the ability to write clear, concise, and well-structured research papers that adhere to academic standards. These skills will not only benefit them in their academic pursuits but also in their future professional careers as researchers, scholars, and professionals in various fields

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Understand that how to improve your writing skills and level of readability
II. Learn about what to write in each section
III. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Interpret the technique of determining a research problem for a crucial part of the research study	Apply
CO 2	Examine the way of methods for avoiding plagiarism in research	Understand
CO 3	Apply the feasibility and practicality of research methodology for a proposed project.	Apply
CO 4	Make use of the legal procedure and document for claiming patent of invention.	Apply
CO 5	Identify different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP	Apply

IV. SYLLABUS:

UNIT-I	**PLANNING AND PREPARATION**	**Classes: 04**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II	**ABSTRACT**	**Classes: 05**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III	**DISCUSSION AND CONCLUSIONS**	**Classes: 05**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT-IV	**WRITING SKILLS**	**Classes: 05**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT-V	QUALITY AND TIME MAINTENANCE	Classes: 05
Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission		
Text Books:		
1. Goldbort R, "Writing for Science", Yale University Press. 2011. 2. Adrian Wallwork, "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011.		
Reference Books:		
1. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM Highman's book.		
Web References:		
1. http://saba.kntu.ac.ir/eecd/ecourses/Seminar90/2011%20English%20for%20Writing%20Research%20Papers.pdf		
E-Text Books:		
1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.		

DISASTER MANAGEMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB33	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In the course on disaster management, students will explore a range of important topics and gain valuable knowledge and skills to effectively address and mitigate the impact of disasters and covers areas like Repercussions of Disasters and Hazards, Disaster-Prone Areas in India, Risk Assessment and Disaster Mitigation

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
II. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
III. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
IV. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Understand to describe the basic types of Environmental hazards and disasters. Understand how to react effectively to natural, manmade, and technological threats.	Understand
CO 2	Understand how to react effectively to natural, manmade, and planetary hazards	Understand
CO 3	Explore the history of the field and comprehend how past events are earthquake, landslides, and volcanic hazards.	Analyze
CO 4	Describe the basic concepts of the emergency management cycle mitigation, preparedness, response, and recovery	Understand
CO 5	Recognizes the stakeholders in disaster management system, their jurisdiction and responsibilities	Remember

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 04

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT-II	REPERCUSSIONS OF DISASTERS AND HAZARDS	Classes: 05

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT-III	DISASTER PRONE AREAS IN INDIA	Classes: 05
Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics		
UNIT-IV	**DISASTER PREPAREDNESS AND MANAGEMENT**	**Classes: 05**
Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.		
UNIT-V	**RISK ASSESSMENT & DISASTER MITIGATION**	**Classes: 05**
Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.		
Text Books:		
1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company.		
Reference Books:		
1. Sahni, PardeepEt.Al, "Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi. Goel S. L. "Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.		
Web References:		
1. http://nptel.ac.in/courses/105101010/downloads/Lecture37.pdf		
E-Text Books:		
1. Disaster management by Vinod k. Sharma		

SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB34	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course, Studying Sanskrit enhances students' analytical thinking and problem-solving abilities. The intricate grammar and logical structure of Sanskrit nurture their analytical skills, enabling them to dissect complex concepts and extract profound insights. This heightened analytical thinking can be applied across different technical disciplines, fostering innovative solutions to contemporary challenges

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Get a working knowledge in illustrious Sanskrit, the scientific language in the world
II. Learning of Sanskrit to improve brain functioning
III. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
IV. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Understand the basic Sanskrit grammar	Understand
CO 2	Formulate simple sentences	Apply
CO 3	Apply order and roots	Apply
CO 4	Understand Ancient Sanskrit literature about science & technology	Understand
CO 5	Develop logical thinking being a logical language in technical concepts	Apply

IV. SYLLUBUS:

UNIT-I	**INTRODUCTION**	**Classes: 04**
Alphabets in Sanskrit, Past/Present/Future Tense		
UNIT-II	**SENTENCES**	**Classes: 04**
Simple Sentences		
UNIT-III	**ROOTS**	**Classes: 04**
Order, Introduction of roots		
UNIT-IV	**SANSKRIT LITERATURE**	**Classes: 04**
Technical information about Sanskrit Literature		
UNIT-V	**TECHNICAL CONCEPTS**	**Classes: 08**
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics		

Text Books:

1. Suresh Soni, “India’s Glorious Scientific Tradition”, Ocean books (P) Ltd., New Delhi.

Reference Books:
1. Dr.Vishwas, “Abhyaspustakam”, Samskrita-Bharti Publication, New Delhi
Web References:
1. http://learnsanskritonline.com/
E-Text Books:
1. Prathama Deeksha-Vempati Kutumb Shastri, “Teach Yourself Sanskrit”, Rashtriya Sanskri Sansthanam, New Delhi Publication.

VALUE EDUCATION

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB35	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In the course on value education, students emerge with a heightened sense of self-awareness, a strong moral foundation, and the skills necessary for personal and professional success. They are equipped with the knowledge and tools to navigate ethical challenges, contribute positively to society, and lead a purposeful and fulfilling life based on their core values and principles.

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Understand value of education and self- development
II. Imbibe good values in students
III. Let the should know about the importance of character

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Understand the significance of ethical human conduct and self-development	Understand
CO 2	Adopt value-based living and holistic technologies to save nature	Apply
CO 3	Inculcate positive thinking, dignity of labor and religious tolerance	Apply
CO 4	Develop the overall Character and Competence through self-management	Analyze
CO 5	Practice Self-control. Honesty through Studying effectively all religious messages	Apply

IV. SYLLABUS:

UNIT-I	VALUES AND SELF-DEVELOPMENT	Classes: 04

Values and self-development. Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

UNIT-II	CULTIVATION OF VALUES	Classes: 06

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

UNIT-III	PERSONALITY AND BEHAVIOR DEVELOPMENT	Classes: 06

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT-IV	CHARACTER AND COMPETENCE	Classes: 03

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women.

UNIT-V	SELF CONTROL	Classes: 03
All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.		
Text Books:		
1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.		
Web References:		
1. http://www.best-personal-development-books.com/personal-value-development.html 2. http://nptel.ac.in/courses/109104068/		
E-Text Books:		
1. R.P. Shukla, “Value education and human rights”.		

CONSTITUTION OF INDIA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB36	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

The course on the Constitution of India provides students with a comprehensive understanding of the historical context, principles, and structure of the Indian Constitution. It explores the journey and philosophy behind the making of the Indian Constitution, highlighting the vision and ideals of the founding fathers.

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Understand the premises informing the twin themes of liberty and freedom from a civil right perspective.
II. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
III. Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Describe historical background of the constitution making and its importance for building a democratic India.	Understand
CO 2	Understand the Constitutional Rights and and duties	Understand
CO 3	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary	Understand
CO 4	Analyse the decentralization of power between central, state and local self-government.	Analyze
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy	Apply

IV. SYLLABUS:

UNIT-I	HISTORY OF MAKING OF THE INDIAN CONSTITUTION & PHILOSOPHY OF THE INDIAN CONSTITUTION	Classes: 08

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution: Preamble, Salient Features

UNIT-II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	Classes: 04

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III	ORGANS OF GOVERNANCE	Classes: 04

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive President, Governor, Council of Minister.

Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT-IV	LOCAL ADMINISTRATION	Classes: 04
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments),Village level: Role of Elected and Appointed officials, Importance of grass root democracy		
UNIT-V	ELECTION COMMISSION	Classes: 04
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.		

Text Books:

1. Dr. S. N. Busi, "Dr. B. R. Ambedkar framing of Indian Constitution", 1st Edition, 2015.
2. M. P. Jain, "Indian Constitution Law", Lexis Nexis, 7th Edition, 2014.

Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Web References:

1. http://www.constitution.org/cons/india/p18.html

E-Text Books:

1. https://www.india.gov.in/my-government/constitution-india/constitution-india-full-text

PEDAGOGY STUDIES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB37	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course in pedagogy studies, students gain a solid foundation in educational principles and practices. They develop a deep understanding of effective teaching and learning strategies, empowering them to create engaging and meaningful learning experiences for their future students. Whether pursuing a career in teaching or any other field that involves knowledge transfer, students emerge with the knowledge and skills to inspire and facilitate learning, making a positive impact on the lives of others.

II.COURSE COURSE OBJECTIVES:

The course should enable the students to:

I. Review existing evidence on the review topic to inform program design and policy making undertaken by the DFID, other agencies and researchers.
II. Identify critical evidence gaps to guide the development.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Identify the Methodology and conceptual framework of teachers education	Understand
CO 2	Understand pedagogical practices are being used by teachers in formal and informal classrooms in developing countries	Understand
CO 3	Interpret the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners	Understand
CO 4	Classify the importance of class room practice, curriculum and learning in Professional Development.	Understand
CO 5	Summarize teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy	Understand

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 04

Introduction And Methodology: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT-II	THEMATIC OVERVIEW	Classes: 02

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III	PEDAGOGICAL PRACTICES	Classes: 04

Evidence on the effectiveness of pedagogical practices. Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.

Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV	PROFESSIONAL DEVELOPMENT	Classes: 04
Professional Development: alignment with classroom practices and follows up Support. Peer support. Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes.		
UNIT-V	**RESEARCH GAPS**	**Classes: 02**
Research gaps and future directions, Research design**,** Contexts**,** Pedagogy**.** Teacher education**.** Curriculum and assessment**.** Dissemination and research impact.		

Text Books:

1. Ackers J, Hardman F, "Classroom interaction in Kenyan primary schools", Compare, 31 (2), 245-261.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361-379.

Reference Books:

1. AkyeampongK, "Teacher training in Ghana - does it count?" Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving Teaching and Learning of Basic Maths and Rreading in Africa: Does teacher preparation count?" International Journal Educational Development, 33 (3): 272–282.

Web References:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education Oxford and Boston: Blackwell

E-Text Books:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

STRESS MANAGEMENT BY YOGA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB38	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In a course on stress management by yoga, engineering students learn a variety of yoga techniques and principles that promote physical, mental, and emotional well-being. These techniques include yoga postures (asanas), breathing exercises (pranayama), meditation, and relaxation techniques.

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to achieve overall health of body and mind.
II. How to overcome stress.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Understand Ashtanga yoga and its importance	Understand
CO 2	Identify the Dos and Do nots of Life by practicing the Yam and Niyam	Analyze
CO 3	Interpret the Shaucha and its components	Understand
CO 4	Make use of breathing techniques and Asan and Pranayam	Understand
CO 5	Develop healthy mind in a healthy body thus improving social health also	Apply

IV. SYLLABUS:

UNIT-I	**INTRODUCTION**	**Classes: 08**
Definitions of Eight parts of yog. (Ashtanga)		
UNIT-II	**YAM AND NIYAM**	**Classes: 04**
Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha		
UNIT-III	**SHAUCHA**	**Classes: 04**
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan		
UNIT-IV	**ASAN AND PRANAYAM**	**Classes: 04**
Asan and Pranayam. Various yog poses and their benefits for mind & body		
UNIT-V	**BREATHING TECHNIQUES**	**Classes: 04**
Regularization of breathing techniques and its effects-Types of pranayam		

Text Books:

1. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata

Reference Books:

1. Janardan Swami, "Yogic Asanas for Group Tarining-Part-I", Yogabhyasi Mandal, Nagpur

Web References:
1. https://americanyoga.school/course/anatomy-for-asana/ 2. https://www.yogaasanasonline.com/
E-Text Books:
1. “Stress Management By Yoga” by Todd A. Hoover, M. D. D., Ht.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BCSB39	Audit	L	T	P	C	CIA	SEE	Total
		2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course, students delve into various aspects of personal development and self-awareness. They learn techniques to improve self-confidence, self-esteem, and self-awareness, which are vital for thriving in their engineering careers. Students explore their strengths, weaknesses, values, and beliefs, enabling them to develop a clearer understanding of themselves and their goals.

II. COURSE OBJECTIVES:

The students will try to learn:

I. How to achieve the highest goal happily
II. How a person become with stable mind, pleasing personality and determination
III. Awaken wisdom in students

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Summarize steps to develop personality with stable mind, pleasing manners and determination.	Understand
CO 2	Identify day to day work and duties for developing peace and prosperity as depicted in Geeta.	Analyze
CO 3	Formulate the daily life style by depicting the verses from Bhagavatgeetha.	Analyze
CO 4	Outline the verses of Shrimad Bhagavad Geetha for holistic development.	Create
CO 5	Demonstrates personality development by verses of Bhagavatgeetha.	Create

IV. SYLLABUS:

UNIT-I	**HOLISTIC DEVELOPMENT**	**Classes: 08**

Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue),Verses- 52,53,59 (dont's),Verses- 71,73,75,78 (do's)

UNIT-II	**BHAGWAD GEETA**	**Classes: 04**

Approach to day to day work and duties. Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48. Chapter 3-Verses 13, 21, 27, 35.

UNIT-III	**BHAGWAD GEETA**	**Classes: 04**

Shrimad BhagwadGeeta: Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

UNIT-IV	**BASIC KNOWLEDGE**	**Classes: 04**

Statements of basic knowledge. Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68. Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT-V	ROLE MODEL	Classes: 04
Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39. Chapter18 – Verses 37,38,63		
Text Books:		
1. P.Gopinath, “Bhartrihari’s Three Satakam (Niti-sringar-vairagya)”, Rashtriya Sanskrit Sansthanam, New Delhi.		
Reference Books:		
1. Swami Swarupananda, “Srimad Bhagavad Gita”,Advaita Ashram (Publication Department), Kolkata.		
Web References:		
1. http://openlearningworld.com/section_personality_development.html		
E-Text Books:		
1. http://persmin.gov.in/otraining/UNDPProject/undp_UNITs/Personality%20Dev%20N%20DLM.pdf		

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. **Who grants Autonomy? UGC, Govt., AICTE or University**

   In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2. **Shall IARE award its own Degrees?**

   No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3. **What is the difference between a Deemed University and an Autonomy College?**

   A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4. **How will the Foreign Universities or other stake – holders know that we are an Autonomous College?**

   Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Telangana mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5. **What is the change of Status for Students and Teachers if we become Autonomous?**

   An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6. **Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?**

   There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7. **Will the students of IARE as an Autonomous College qualify for University Medals and Prizes for academic excellence?**

   No. IARE has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8. **Can IARE have its own Convocation?**

   No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at IARE.

9. **Can IARE give a provisional degree certificate?**

   Since the examinations are conducted by IARE and the results are also declared by IARE, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10. Will Academic Autonomy make a positive impact on the Placements or Employability?

Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11. What is the proportion of Internal and External Assessment as an Autonomous College?

Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12. Is it possible to have complete Internal Assessment for Theory or Practicals?

Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13. Why Credit based Grade System?

The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14. What exactly is a Credit based Grade System?

The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like A, B,C,D, etc. are assigned for a Range of Marks. (e.g. 91% and above is A+, 80 to 90 % could be A etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15. What are the norms for the number of Credits per Semester and total number of Credits for UG/PG programme?

These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16. What is a Semester Grade Point Average (SGPA)?

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and $G_i$is the grade point scored by the student in the i^{th} course and $i$represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17. What is a Cumulative Grade Point Average (CGPA)?

An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{n} (C_i S_i) / \sum_{j=1}^{n} C_i$$

Where,S_i is the SGPA of the i^{th}semester and $C_i$is the total number of credits in that semester and *j*represent the number of courses in which a student's is registered upto the semester. CGPA is rounded to two decimal places.

18. Is there any Software available for calculating Grade point averages and converting the same into Grades?

Yes,The institute has its own MIS software for calculation of SGPA,CGPA,etc.

19. Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?

No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20. Will there be any Revaluation or Re-Examination System?

No. There will double valuation of answer scripts. There will be a make up Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21. How fast Syllabi can be and should be changed?

Autonomy allows us the freedom to change the syllabi as often as we need.

22. Will the Degree be awarded on the basis of only final yearperformance?

No. The CGPA will reflect the average performance of all the semester taken together.

23. What are Statutory Academic Bodies?

Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in everybody is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24. Who takes Decisions on Academic matters?

The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25. What is the role of Examination committee?

The Examinations Committee is responsible for the smooth conduct of internal, End Semester and make up Examinations. All matters involving the conduct of examinations, spot valuations, tabulations and preparation of Grade Cards etc fall within the duties of the Examination Committee.

26. Is there any mechanism for Grievance Redressal?

The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27. How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulation

28. Who declares the result?

The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual

deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29. Who will keep the Student Academic Records, University or IARE?

It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve all the records.

30. What is our relationship with the JNT University?

We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31. Shall we require University approval if we want to start any New Courses?

Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32. Shall we get autonomy for PG and Doctoral Programmes also?

Yes, presently our PG programs also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and

		project work and shall not be permitted for the remaining examinations of the subjects of that semester / year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

UNDERTAKING BY STUDENT / PARENT

"To make the students attend the classes regularly from the first day of starting of classes and be aware of the College regulations, the following Undertaking Form is introduced which should be signed by both student and parent. The same should be submitted to the Dean, Academic".

I, Mr./Ms ---------- joining I Semester for the academic year 2019-2020 in Institute of Aeronautical Engineering, Hyderabad, do hereby undertake and abide by the following terms, and I will bring the ACKNOWLEDGEMENT duly signed by me and my parent and submit it to the Dean, Academic.

1. I will attend all the classes as per the timetable from the starting day of the semester specified in the institute Academic Calendar. In case, I do not turn up even after two weeks of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (theory/practical/drawing) and secure attendance of not less than 80% in every course as stipulated by Institute. I am fully aware that an attendance of less than 70% in more than three courses will make me lose one year.
3. I will compulsorily follow the dress code prescribed by the college.
4. I will conduct myself in a highly disciplined and decent manner both inside the classroom and on campus, failing which suitable action may be taken against me as per the rules and regulations of theinstitute.
5. I will concentrate on my studies without wasting time in the Campus/Hostel/Residence and attend all the tests to secure more than the minimum prescribed Class/Sessional Marks in each course. I will submit the assignments given in time to improve my performance.
6. I will not use Mobile Phone in the institute premises and also, I will not involve in any form of ragging inside or outside the campus. I am fully aware that using mobile phone to the institute premises is not permissible and involving in Ragging is an offence and punishable as per JNTUH/UGC rules and the law.
7. I declare that I shall not indulge in ragging, eve-teasing, smoking, consuming alcohol drug abuse or any other anti-social activity in the college premises, hostel, on educational tours, industrial visits or elsewhere.
8. I will pay tuition fees, examination fees and any other dues within the stipulated time as required by the Institution / authorities, failing which I will not be permitted to attend the classes.
9. I will not cause or involve in any sort of violence or disturbance both within and outside the collegecampus.
10. If I absent myself continuously for 3 days, my parents will have to meet the HOD concerned/ Principal.
11. I hereby acknowledge that I have received a copy of IARE - R18 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

ACKNOWLEDGEMENT

I have carefully gone through the terms of the undertaking mentioned above and I understand that following these are for my/his/her own benefit and improvement. I also understand that if I/he/she fail to comply with these terms, shall be liable for suitable action as per Institute/JNTUH/AICTE/UGC rules and the law. I undertake that I/he/she will strictly follow the above terms.

Signature of Student with Date

Signature of Parent with Date
Name & Address with Phone Number