VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

(Permanently Affiliated to JNTUH, Approved by AICTE, New Delhi and Accredited by NBA)

Shamshabad – 501 218, Hyderabad

MASTER OF TECHNOLOGY
ENGINEERING DESIGN

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI FOR M.TECH – ENGINEERING DESIGN UNDER AUTONOMOUS STATUS FOR THE BATCHES ADMITTED FROM THE ACADEMIC YEAR 2011 - 12

Note: The regulations hereunder are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program) as may be decided by the Academic Council.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

- "Autonomous Institute / College" means an institute / college designated as autonomous institute / college by the Jawaharlal Nehru Technological University, Hyderabad (JNTUH), as per the JNTUH Autonomous College Statutes, 2011.
- "Academic Autonomy" means freedom to a College in all aspects of conducting its academic programs, granted by the University for promoting excellence.
- "Commission" means University Grants Commission.
- "AICTE" means All India Council for Technical Education.
- "University" the Jawaharlal Nehru Technological University, Hyderabad.
- "College" means Vardhaman College of Engineering, Hyderabad unless indicated otherwise by the context.
- "Program" means:
  Bachelor of Technology (B.Tech) degree program
  UG Degree Program: B.Tech
  PG degree Program: M.Tech
- "Branch" means specialization in a program like M.Tech degree program in Power Electronics and Electrical Drives.
- "Course" or "Subject" means a theory or practical subject, identified by its course – number and course-title, which is normally studied in a semester. For example, ABS11T01: Mathematics - I, ACS11T02: Data Structures through C, etc.
- T – Tutorial, P – Practical, D – Drawing, L - Theory, C - Credits

FOREWORD

The autonomy is conferred on Vardhaman College of Engineering by J N T University, Hyderabad 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 UGC 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.

Vardhaman College of Engineering 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 College and recommendations of the JNTU Hyderabad 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 college 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

VARDHAMAN COLLEGE OF ENGINEERING

(Autonomous)

(Permanent Affiliation with JNTUH, Approved by AICTE, New Delhi and Accredited by NBA)

ACADEMIC REGULATIONS

M. Tech. Regular Two Year Post-Graduate Programme

(For the batches admitted from the academic year 2011–12)

For pursuing Two year degree program of study in Master of Technology (M.Tech.) offered by Vardhaman College of Engineering under Autonomous status and herein after referred to as VCE:

1. APPLICABILITY

All the rules specified herein, approved by the Academic Council, will be in force and applicable to students admitted from the academic year 2011-2012 onwards. Any reference to "College" in these rules and regulations stands for Vardhaman College of Engineering.

2. EXTENT

All the rules and regulations, specified herein after shall be read as a whole for the purpose of interpretation and as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies Principal, Vardhaman College of Engineering shall be the Chairman, Academic Council.

3. PROGRAMS OFFERED

Vardhaman College of Engineering, an autonomous college affiliated to JNTUH, offers the following M.Tech programmes of study leading to the award of M.Tech degree under the autonomous scheme.

S. No	M.Tech Courses	Intake
1	Computer Science and Engineering	36
2	Software Engineering	18
3	Digital Electronics and Communication Systems	36
4	Wireless and Mobile Communications	18
5	Power Electronics and Electrical Drives	18

4. ADMISSION

Admission into first year of Two Year M.Tech Program shall be made subject to the eligibility, qualifications and specialization as per the guidelines prescribed by the APSCHE and AICTE from time to time.

5. DURATION OF THE PROGRAMS

5.1 Normal Duration

M.Tech degree program extends over a period of two academic years leading to the Degree of Master of Technology (M.Tech) of the Jawaharlal Nehru Technology University, Hyderabad.

5.2 Maximum Duration

5.2.1 The maximum period within which a student must complete a full-time academic program is 4 years for M.Tech. If a student fails to complete the academic program within the maximum duration as specified above, he / she will be required to withdraw from the program.

5.2.3 The period is reckoned from the academic year in which the student is admitted first time into the degree programme.

6. SEMESTER STRUCTURE

The College 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 duration and this period includes time for course work, examination preparation, and conduct of examinations. Each semester shall have a minimum of 90 working days. The academic calendar is shown in Table 1 is declared at the start of the semester. The duration for each semester shall be a minimum of 17 weeks of instruction.

Table 1: Academic Calendar

FIRST SEMESTER (23 weeks)	I Spell Instruction Period	: 9 weeks	19 weeks
	I Mid Examinations	: 1 week	
	II Spell Instruction Period	: 8 weeks	
	II Mid Examinations	: 1 Week	
	Preparation & Practical Examinations		2 weeks
	External Examinations		2 weeks
Semester Break			2 weeks
SECOND SEMESTER (23 weeks)	I Spell Instruction Period	: 9 weeks	19 weeks
	I Mid Examinations	: 1 week	
	II Spell Instruction Period	: 8 weeks	
	II Mid Examinations	: 1 Week	
	Preparation & Practical Examinations		2 weeks
	External Examinations		2 weeks
Summer Vacation			4 weeks
THIRD SEMESTER	Project Work Phase – I		18 Weeks
FOURTH SEMESTER	Project Work Phase – II		18 Weeks

7. CREDIT BASED SYSTEM

All the academic programs under autonomy are based on credit system. Credits are assigned based on the following norms:

7.1. The duration of each semester will normally be 23 weeks with 5 days a week. A working day shall have 6 periods each of 60 minutes duration.

- 1 credit per lecture period per week
- 2 credits for three (or more) period hours of practicals
- 2 credits for technical seminar
- 4 credits for comprehensive viva examination
- 18 credits for project work phase – I
- 22 credits for project work phase – II

7.2. The two year curriculum of any M.Tech programme of study shall have total of 88 credits. The exact requirements of credits for each course will be as recommended by the Board of Studies concerned and approved by the Academic Council.

7.3. For courses like technical seminar / comprehensive viva / Project Work Phases – I and II, where formal contact hours are not specified, credits are assigned based on the complexity of the work to be carried out.

8. METHOD OF EVALUATION

The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks each for theory and 100 marks for practical, on the basis of Internal Evaluation and End Semester Examination.

8.1 **Theory**

For all lecture based theory courses, the evaluation shall be for 40 marks through internal evaluation and 60 marks through external end semester examination of three hours duration.

8.1.1. Internal evaluation

For theory subjects, during the semester there shall be 2 midterm examinations. Each midterm examination consists of subjective test. The subjective test is for 40 marks, with duration of 2 hours. The Mid-Term Examination question paper shall be set with **six** questions out of which **four** are to be answered. All questions carry equal marks.

First midterm examination shall be conducted for I – IV units of syllabus and second midterm examination shall be conducted for the remaining portion.

The internal marks shall be computed as the average of the two internal evaluations, of two subjective tests.

8.1.2. External Evaluation

The question paper shall be set externally and valued both internally and externally. The external end semester examination question paper in theory subjects will be for a maximum of 60 marks to be answered in three hours duration. For End-Semester examination, the candidate has to answer any five out of eight questions. Each question carries 12 marks. Each theory course shall consist of eight units of syllabus.

8.2. **Practicals**

Practicals shall be evaluated for 100 marks, out of which 60 marks are for external examination and 40 marks are for internal evaluation. The 40 internal marks are distributed as 25 marks for day-to-day work and 15 marks for internal examination. The external end - examination shall be conducted by the teacher concerned and an external examiner from outside the college.

8.3. **Technical Seminar**

The seminar shall have two components, one chosen by the student from the course-work without repetition and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work. A hard copy of the information on seminar topic in the form of a report is to be submitted for evaluation along with presentation. The presentation of the seminar topics shall be made before an internal evaluation committee comprising the Head of the Department or his/her nominee, seminar supervisor and a senior faculty of the department. The two components of the seminar are distributed between two halves of the semester and are evaluated for 50 marks each. The average of the two components shall be taken as the final score. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.

8.4. **Comprehensive Viva**

The comprehensive Viva will be conducted by a committee comprising Head of the Department or his/her nominee, two senior faculty of the respective department and an external examiner from outside the college. This is aimed at assessing the student's understanding of various subjects studied during the entire program. The comprehensive viva shall be evaluated for 50 marks at the end of III semester. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.

8.5. **Project Work**

The project work shall be evaluated for 200 marks out of which 50 marks for phase – I internal evaluation, 50 marks for phase – II internal evaluation and 100 marks for end semester evaluation. A minimum of 50% of marks on the aggregate in the internal evaluation and external end-evaluation taken together shall be obtained to earn the corresponding credits.

Every candidate is required to submit dissertation after taking up a topic approved by the Departmental Committee. The project work shall be spread over in III semester and in IV semester. The project work shall be somewhat innovative in nature, exploring the research bent of mind of the student.

The Departmental Committee (DC) consists of HOD, Supervisor and two senior experts in the department. The committee monitors the progress of Project Work. The DC is constituted by the Principal on the recommendations of the department Head.

Student shall register for the Project work with the approval of Departmental Committee in the III Semester and continue the work in the IV Semester too. The Departmental Committee (DC) shall monitor the progress of the project work. In III Semester, Phase – I of the Project Work is to be completed. A Student has to identify the topic of work, collect relevant Literature, preliminary data, implementation tools / methodologies etc., and perform a critical study and analysis of the problem identified. He shall submit status report in two different phases in addition to oral presentation before the Departmental Committee for evaluation and award of 50 internal marks at the end of Phase – I.

A candidate shall continue the Project Work in IV Semester (Phase – II) and submit a Project report at the end of Phase – II after approval of the Departmental Committee. During Phase – II, the student shall submit status report in two different phases, in addition to oral presentation before the DC. The DC shall evaluate the project for 50 internal marks based on the progress, presentations and quality of work.

A candidate shall be allowed to submit the dissertation only after passing all the courses of I and II semesters with the approval of Departmental Committee not earlier than **40 weeks** from the date of registration of the project work and then take viva-voce examination. The viva-voce examination may be conducted once in three months for all the eligible candidates.

Three copies of the dissertation certified in the prescribed form by the supervisor and HOD shall be presented to the Department and one copy is to be submitted to the Controller of Examinations, VCE and one copy to be sent to the examiner.

The department shall submit a panel of three experts for a maximum of 5 students at a time. However, the examiners for conducting viva-voce examination shall be nominated by the Controller of Examinations, VCE. If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the dissertation. The board shall jointly evaluate the project work for 100 marks. The candidates who fail in viva-voce examinations shall have to re-appear the viva-voce examination after three months. If he fails again in the second viva-voce examination, the candidate has to re-register for the Project Work.

If a candidate desires to change the topic of the project already chosen during Phase – I, he has to re-register for Project work with the approval of the DC and repeat Phases – I and II. Marks already earned in Phase – I stand cancelled.

9. ATTENDANCE REQUIREMENTS TO APPEAR FOR THE SEMESTER-END EXAMINATION

9.1. A student shall be eligible to appear for semester-end examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.

9.2. Condonation of shortage of attendance in aggregate upto 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

9.3. Shortage of attendance below 65% in aggregate shall in no case be condoned.

9.4. Students whose shortage of attendance is not condoned in any semester are not eligible to take their semester-end examination of that class and their registration shall stand cancelled.

9.5. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the current semester. The student may seek readmission for the semester when offered next. He will not be allowed to register for the subjects of the semester while he is in detention. A student detained due to shortage of attendance, will have to repeat that semester when offered next.

9.6. A stipulated fee shall be payable towards condonation of shortage of attendance to the College.

9.7. Attendance may also be condoned as per the recommendations of academic council for those who participate in prestigious sports, co-curricular and extra-curricular activities provided as per the Govt. of AP norms in vogue.

10. ACADEMIC REQUIREMENTS FOR PROMOTION / COMPLETION OF REGULAR M.TECH PROGRAMME OF STUDY

The following academic requirements have to be satisfied in addition to the attendance requirements for promotion / completion of regular M.Tech programme of study.

i. A student shall be deemed to have satisfied the minimum academic requirements for each theory, and practical, if he secures not less than 40% of marks in the semester-end examination and a minimum of 50% of marks in the sum of the internal evaluation and semester - end examination taken together.

ii. In case of technical seminar and comprehensive viva a student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each of them if he/she secures not less than 50% of marks.

iii. In case of project work, a student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted if he/she secures not less than 50% of marks on the aggregate in the internal evaluation and external end-evaluation taken together.

iv. A student shall register for all the 88 credits and earn all the 88 credits. Marks obtained in all the 88 credits shall be considered for the award of the class based on aggregate of marks.

v. A student who fails to earn 88 credits as indicated in the course structure within **FOUR** academic years from the year of their admission shall forfeit their seat in M.Tech programme and their admission stands cancelled.

viii. Students who are detained for want of attendance (or) who have not fulfilled academic requirements (or) who have failed after having undergone the course in earlier regulations (or) have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same (or) equivalent subjects as and when subjects are offered, and pursue the remaining course work with the academic regulations of the batch into which such students are readmitted. However, all such readmitted students shall earn all the credits of subjects they have pursued for completion of the course.

11. EVALUATION

Following procedure governs the evaluation.

11.1. Marks for components evaluated internally by the faculty should be submitted to the Controller of Examinations one week before the commencement of the semester-end examinations. The marks for the internal evaluation components will be added to the external evaluation marks secured in the semester-end examinations, to arrive at total marks for any subject in that semester.

11.2. Performance in all the courses is tabulated course-wise and will be scrutinized by the Examination Committee and moderation is applied if needed, based on the recommendations of moderation committee and course-wise marks lists are finalized.

11.3. Student-wise tabulation is done and student-wise memorandum of marks is generated which is issued to the student.

12. SUPPLEMENTARY EXAMINATION

Supplementary examinations for the odd semester shall be conducted with the regular examinations of even semester and vice versa, for those who appeared and failed in regular examinations. Such of the candidates writing supplementary examinations may have to write more than one examination per day.

13. RE-REGISTRATION FOR IMPROVEMENT OF INTERNAL

Following are the conditions to avail the benefit of improvement of internal marks.

13.1. The candidate should have completed the course work and obtained examinations results for I & II semesters.

13.2. A candidate shall be given one chance for a maximum of Three Theory subjects for Improvement of Internal evaluation marks for which the candidate has to re-register for the chosen subjects and fulfill the academic requirements.

13.3. For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D. in favour of the Principal, Vardhaman College of Engineering payable at Hyderabad along with the requisition through the concerned Head of the Department.

13.4. In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the re-registered subjects stand cancelled.

14. PERSONAL VERIFICATION

Students shall be permitted for personal verification of the semester-end examination answer scripts within a stipulated period after payment of prescribed fee.

15. TRANSITORY REGULATIONS

Students who are detained for want of attendance (or) who have not fulfilled academic requirements (or) who have failed after having undergone the course in earlier regulations (or) have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same (or) equivalent subjects as and when subjects are offered, and pursue the remaining course work with the academic regulations of the batch into which such students are readmitted. A regular student has to satisfy all the eligibility requirements within the maximum stipulated period of four years for the award of M.Tech Degree.

16. TRANSCRIPTS

After successful completion of the entire programme of study, a transcript containing performance of all academic years will be issued as a final record. Transcripts will also be issued, if required, after payment of requisite fee. Partial transcript will also be issued upto any point of study to a student on request, after payment of requisite fee.

17. AWARD OF DEGREE

The degree will be conferred and awarded by Jawaharlal Nehru Technological University, Hyderabad on the recommendations of the Chairman, Academic Council.

17.1. Eligibility

A student shall be eligible for the award of M.Tech. Degree, if he fulfills all the following conditions:

i. Registered and successfully completed all the components prescribed in the programme of study to which he is admitted.

ii. Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of study within the stipulated time.

iii. Obtained not less than 50% of marks (minimum requirement for declaring as passed).

iv. Has no dues to the college, hostel, and library etc. and to any other amenities provided by the College.

v. No disciplinary action is pending against him.

17.2. **Award of Class**

Declaration of Class is based on percentage of marks to be secured.

After a student has satisfied the requirement prescribed for the completion of the programme and is eligible for the award of M.Tech. Degree he shall be placed in one of the following four classes Shown in Table 4:

Table 4: Declaration of Class is based on percentage of marks to be secured

Class Awarded	% of marks to be secured	
First Class with Distinction	70% and above	From the aggregate marks secured for the 88 Credits.
First Class	Below 70% but not less than 60%	
Second Class	Below 60% but not less than 50%	
Fail	Below 50%	

Sometimes, it is necessary to provide equivalence of percentages and/or *Class* awarded with *Grade Point Average (GPA).* This shall be done by prescribing certain specific thresholds in averages for *Distinction, First Class and Second Class,* as in Table 5.

Table 5: Percentage Equivalence of *Grade Points* (For a 10-Point Scale)

Grade Point	Percentage of Marks / Class
5.75	50 (Second Class)
6.25	55
6.75	60 *(First Class)*
7.25	65
7.75	70 *(First Class with Distinction)*
8.25	75

18. REGISTRATION

Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely compulsory for the student to register for courses in time.

19. TERMINATION FROM THE PROGRAM

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

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

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

20. CURRICULUM

20.1. For each program being offered by the Institute, a Board of Studies (BOS) is constituted in accordance with AICTE / UGC / JNTUH statutes.

20.2. The BOS for a program is completely responsible for designing the curriculum once in three years for that program.

21. 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, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

22. GRIEVANCES REDRESSAL COMMITTEE

"Grievance and Redressal Committee" (General) constituted by the principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters. The composition of the complaints cum redressal committee shall be:

Headed by Senior Faculty member
Heads of all departments
A senior lady staff member from each department (if available)

The committee constituted shall submit a report to the principal of the college, the penalty to be imposed. The Principal upon receipt of the report from the committee shall, after giving an opportunity of being heard to the person complained against, submit the case with the committee's recommendation to the Governing Body of the college. The Governing Body shall confirm with or without modification the penalty recommended after duly following the prescribed procedure.

23. MALPRACTICE PREVENTION COMMITTEE

A malpractice prevention committee shall be constituted to examine and punish the students who does malpractice / behaves indiscipline in examinations. The committee shall consist of:

Principal
Subject expert of which the subject belongs to
Head of the department of which the student belongs to
The invigilator concerned
In-charge Examination branch of the college

The committee constituted shall conduct the meeting on the same day of examination or latest by next working day to the incidence and punish the student as per the guidelines prescribed by the J N T University, Hyderabad from time to time.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

24. AMENDMENTS TO REGULATIONS

The Academic Council of Vardhaman College of Engineering reserves the right to revise, amend, or change the regulations, scheme of examinations, and / or syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

25. STUDENTS' FEEDBACK

It is necessary for the Colleges to obtain feedback from students on their course work and various academic activities conducted. For this purpose, suitable feedback forms shall be devised by the College and the feedback obtained from the students regularly in confidence, by administering the feedback form in print or on-line in electronic form.

The feedback received from the students shall be discussed at various levels of decision making at the College and the changes/ improvements, if any, suggested shall be given due consideration for implementation.

26. GRADUATION DAY

The College 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 Awards to meritorious students, for being given away annually at the *Graduation Day.* This will greatly encourage the students to strive for excellence in their academic work.

27. AWARD OF A RANK UNDER AUTONOMOUS SCHEME

27.1. One (1) Merit Rank will be declared only for those students who have been directly admitted in VCE under Autonomous Regulations and complete the entire course in VCE only within the minimum possible prescribed time limit, i.e., 2 years for M.Tech.

27.2. A student shall be eligible for a merit rank at the time of award of degree in each branch of Master of Technology, provided the student has passed all subjects prescribed for the particular degree program in first attempt only.

27.5. Award of prizes, scholarships, or any other Honours shall be based on the rank secured by a candidate, consistent with the guidelines of the Donor, wherever applicable.

28. CONDUCT AND DISCIPLINE

28.1 Each student shall conduct himself / herself in a manner befitting his / her association with VCE.

28.2 He / she is expected not to indulge in any activity, which is likely to bring disrepute to the college.

28.3 He / she should show due respect and courtesy to the teachers, administrators, officers and employees of the college and maintain cordial relationships with fellow students.

28.4 Lack of courtesy and decorum unbecoming of a student (both inside and outside the college), wilful damage or removal of Institute's property or belongings of fellow students, disturbing others in their studies, adoption of unfair means during examinations, breach of rules and regulations of the Institute, noisy and unruly behaviour and similar other undesirable activities shall constitute violation of code of conduct for the student.

28.5 **Ragging in any form is strictly prohibited and is considered a serious offence. It will lead to the expulsion of the offender from the college.**

28.6 Violation of code of conduct shall invite disciplinary action which may include punishment such as reprimand, disciplinary probation, debarring from the examination, withdrawal of placement services, withholding of grades / degrees, cancellation of registration, etc., and even expulsion from the college.

28.7 Principal, based on the reports of the warden of Institute hostel, can reprimand, impose fine or take any other suitable measures against an inmate who violates either the code of conduct or rules and regulations pertaining to college hostel.

28.8 A student may be denied the award of degree / certificate even though he / she have satisfactorily completed all the academic requirements if the student is found guilty of offences warranting such an action.

28.9 Attendance is not given to the student during the suspension period.

29. OTHER ISSUES

The quality and standard of engineering professionals are closely linked with the level of the technical education system. As it is now recognized that these features are essential to develop the intellectual skills and knowledge of these professionals for being able to contribute to the society through productive and satisfying careers as *innovators, decision makers and/or leaders* in the global economy of the 21st century, it becomes necessary that certain improvements are introduced at different stages of their education system. These include:

i. Selective admission of students to a programme, so that merit and aptitude for the chosen technical branch or specialization are given due consideration.

ii. Faculty recruitment and orientation, so that qualified teachers trained in good teaching methods, technical leadership and students' motivation are available.

iii. Instructional/Laboratory facilities and related physical infrastructure, so that they are adequate and are at the contemporary level.

iv. Access to good library resources and Information & Communication Technology **(ICT)** facilities, to develop the student's *mind* effectively.

These requirements make it necessary for the College to introduce improvements like:

i. Teaching-learning process on modern lines, to provide *Add-On* Courses for *audit*/credit in a number of peripheral areas useful for students' self development.

ii. Life-long learning opportunities for faculty, students and alumni, to facilitate their dynamic interaction with the society, industries and the world of work.

iii. Generous use of ICT and other modern technologies in everyday activities.

30. GENERAL

Where the words "he", "him", "his", "himself" occur in the regulations, they include "she", "her", "herself".

Note: Failure to read and understand the regulations is not an excuse.

COURSE STRUCTURE

M. TECH - ENGINEERING DESIGN

REGULATIONS: VCE--R11

I SEMESTER

Code	Subject	Periods per Week		Credits	Scheme of Examination Maximum Marks		
		L	P		Internal	External	Total
B1701	Applied Mathematics	3	-	3	40	60	100
B1702	Advanced Mechanics of Solids	3	-	3	40	60	100
B1703	Advanced Mechanisms	3	-	3	40	60	100
B1704	Finite Element Methods	3	-	3	40	60	100
PROFESSIONAL ELECTIVE - I		3	-	3	40	60	100
PROFESSIONAL ELECTIVE - II		3	-	3	40	60	100
B1711	Simulation Lab	-	3	2	40	60	100
B1712	Technical Seminar	-	-	2	50	-	50
TOTAL		**18**	**03**	**22**	**330**	**420**	**750**

II SEMESTER

Code	Subject	Periods per week		Credits	Scheme of Examination Maximum Marks		
		L	P		Internal	External	Total
B1713	Robotics	3	-	3	40	60	100
B1714	Mechanical Vibrations	3	-	3	40	60	100
B1715	Advanced Optimization Techniques	3	-	3	40	60	100
B1716	Gear Engineering	3	-	3	40	60	100
PROFESSIONAL ELECTIVE - III		3	-	3	40	60	100
PROFESSIONAL ELECTIVE - IV		3	-	3	40	60	100
B1723	Machine Dynamics Lab	-	3	2	40	60	100
B1724	Technical Seminar	-	-	2	50	-	50
TOTAL		**18**	**03**	**22**	**330**	**420**	**750**

III SEMESTER

Code	Subject	Periods per week		Credits	Scheme of Examination Maximum Marks		
		L	P		Internal	External	Total
B1725	Comprehensive Viva	-	-	4	-	50	50
B1726	Project Work Phase - I	-	-	18	50	-	50
TOTAL		**-**	**-**	**22**	**50**	**50**	**100**

IV SEMESTER

Code	Subject	Periods per week		Credits	Scheme of Examination Maximum Marks		
		L	P		Internal	External	Total
B1727	Project Work Phase - II	-	-	22	50	100	150
TOTAL		**-**	**-**	**22**	**50**	**100**	**150**

M. TECH - ENGINEERING DESIGN

REGULATIONS: VCE--R11

ELECTIVES	
PROFESSIONAL ELECTIVE - I	
Code	**Subject**
B1705	Mechatronics System Design
B1706	Fracture, Fatigue and Creep Deformation
B1707	Tribology and Bearing Design
PROFESSIONAL ELECTIVE - II	
B1708	Mechanics of Composite Materials
B1709	Design For Manufacturing
B1710	Theory of Elasticity
PROFESSIONAL ELECTIVE - III	
B1717	Computer Applications in Design
B1718	Computational Fluid Dynamics
B1719	Theory of Plates
PROFESSIONAL ELECTIVE - IV	
B1720	Pressure Vessel and Piping Design
B1721	Nano Technology
B1722	Robust Design

SYLLABAI FOR I SEMESTER

M. Tech. ED I SEMESTER

APPLIED MATHEMATICS

Course Code: **B1701**

L	P	C
3	-	3

UNIT - I

APPROXIMATIONS AND ROUND OFF ERRORS: Significant figures, Accuracy and Precision, Error Definitions, Round off Errors and Truncation Errors. Mathematical Modeling and Engineering Problem Solving: Simple Mathematical Model, Conservation Laws of Engineering.

UNIT - II

ROOTS OF EQUATIONS: Bracketing Methods-Graphical Method, Bisection Method, False Position Method, Newton- Raphson Method, Secant Method. Multiple Roots, Simple fixed point Iteration.

UNIT - III

ROOTS OF POLYNOMIAL: Polynomials in Engineering and Science, Muller's Method, Bairstow's Method, Graeffe's Roots Squaring Method.

UNIT - IV

NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION: Newton–Cotes and Guass Quadrature Integration Formulae, Integration of Equations, Romberg Integration, Numerical Differentiation Applied to Engineering Problems, High Accuracy Differentiation Formulae.

UNIT - V

SYSTEM OF LINEAR ALGEBRAIC EQUATIONS AND EIGENVALUE PROBLEMS: Introduction, Direct Methods, Cramer's Rule, Gauss Elimination Method, Gauss-Jordan Elimination Method, Triangularization Method, Cholesky Method, Partition Method, Error Analysis for Direct Methods, Iteration Methods.

UNIT - VI

EIGEN VALUES AND EIGEN VECTORS: Bounds on Eigen Values, Jacobi Method for Symmetric Matrices, Givens Method for Symmetric Matrices, Householder's Method for Symmetric Matrices, Rutishauser Method for Arbitrary Matrices, Power Method, Inverse Power Method.

UNIT - VII

LINEAR TRANSFORMATION: Introduction to Linear Transformation, The Matrix of Linear Transformation, Linear Models in Science and Engineering.

UNIT - VIII

ORTHOGONALITY AND LEAST SQUARES: Inner product, Length and Orthogonality, Orthogonal Sets, Orthogonal Projections, The Gram-Schmidt Process, Least Square Problems, Inner Product Spaces.

TEXT BOOKS:

1. S. S. Sastry (2012), *Introductory Methods of Numerical Analysis*, 5th edition, Prentice Hall of India, New Delhi, India.
2. Steven Chapra, Raymond Canale (2010), *Numerical Methods for Engineers,* 6th edition, Tata McGraw-Hill, New Delhi, India.
3. M. K. Jain, S. R. K. Iyengar, R. K. Jain (2012), *Numerical Methods: For Scientific and Engineering Computation,* 6th Edition*,* New Age International, New Delhi

REFERENCE BOOKS:

1. Parviz Moin (2010), *Fundamentals of Engineering Numerical Analysis,* 2nd Edition, Cambridge University Press, New York, USA.
2. David. C. Lay (2012), *Linear Algebra and Its Applications*, 4th International Edition, Pearson Education, New Delhi, India.

M. Tech. ED I SEMESTER

ADVANCED MECHANICS OF SOLIDS

Course Code: **B1702**

L	P	C
3	-	3

UNIT - I

SHEAR CENTER: Bending Axis and Shear Center- Shear Center for Axis-Symmetric and Unsymmetrical Sections.

UNIT - II

UNSYMMETRICAL BENDING: Bending Stresses in Beams Subjected to Nonsymmetrical Bending; Deflection of Straight Beams due to Nonsymmetrical Bending.

UNIT - III

CURVED BEAM THEORY: Winkler Bach Formula for Circumferential Stress, Limitations, Correction Factors, Radial Stress in Curved Beams, Closed Ring Subjected to Concentrated and Uniform Loads Stresses in Chain Links.

UNIT - IV

TORSION: Linear Elastic Solution; Prandtl Elastic Membrane (Soap-Film) Analogy; Narrow Rectangular Cross Section ; Hollow Thin wall Torsion Members, Multiply connected Cross Section.

UNIT - V

TWO DIMENSIONAL ELASTICITY PROBLEMS - I: Plane Stress and Plain Strain-Problems in Rectangular Coordinates, Bending of Cantilever Loaded at the End, Bending of a Beam by Uniform Load.

UNIT - VI

TWO DIMENSIONAL ELASTICITY PROBLEMS - II: Plane Stress and Plain Strain-Problems in Polar Coordinates, General Equations in Polar Coordinates, Stress Distribution Symmetrical about an Axis, Pure Bending of Curved bars, Displacements for Symmetrical Stress Distributions, Rotating discs.

UNIT - VII

BEAMS ON ELASTIC FOUNDATION: General theory - Infinite Beam Subjected to Concentrated Load: Boundary conditions - Infinite Beam Subjected to a Distributed Load Segment - Semi-infinite Beam Subjected to loads of its End - Semi-infinite Beam with Concentrated load near its End - Short Beams.

UNIT - VIII

CONTACT STRESSES: Introduction; Problem of Determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact, Normal and Tangent to contact area.

TEXT BOOKS:

1. Arthur P. Boresi, Richard J. Schmidt (2009), *Advanced Mechanics Of Materials,* 6th Edition, Wiley India Ltd, New Delhi, India.
2. Stephan Timoshenko, J. N. Goodier (2010), *Theory of elasticity*, 3rd edition ,Tata McGraw Hill Education Private Limited, New Delhi, India.

REFERENCE BOOKS:

1. Jacob Pieter Den Hartog (1987), *Advanced strength of materials*, New Edition, Dover Publications, New York.
2. Stephan Timoshenko (2010), *Theory of Plates & Shells*, 2nd Edition, Tata McGraw-Hill Education Private Limited, New Delhi, India.
3. Henry Taylor Bovey (2010), *Theory of Structures and Strength of Materials*, Photo Copy Edition, Nabu Press, USA.
4. Sadhu Singh (2009), *Strength of Materials,* 10th Edition, Khanna Publishers, New Delhi, India.

M. Tech. ED I SEMESTER

ADVANCED MECHANISMS

Course Code: **B1703**

L	P	C
3	-	3

UNIT - I

INTRODUCTION: Elements of Mechanisms; Mobility Criterion for Planar Mechanisms and Manipulators; Mobility Criterion for Spatial Mechanisms and Manipulators. Spherical Mechanisms, Spherical Trigonometry.

UNIT - II

ADVANCED KINEMATICS OF PLANE MOTION - I: The Inflection circle ; Euler - Savary Equation; Analytical and Graphical Determination of Diameter; Bobillier Construction; Collineation Axis ; Hartmann Construction; Inflection Circle for the Relative Motion of Two Moving Planes; Application of the Inflection circle to Kinematic Analysis.

UNIT - III

ADVANCED KINEMATICS OF PLANE MOTION - II: Polode Curvature; Hall Equation; Polode Curvature in the Four bar mechanism; Coupler Motion; Relative Motion of the Output and Input Links; Determination of the output Angular acceleration and its Rate of change; Freudenstein's collineation - axis theorem; Carter–Hall circle; The Circling – Point curve for the Coupler of a Four bar mechanism.

UNIT - IV

INTRODUCTION TO SYNTHESIS-GRAPHICAL METHODS - I: The Four bar linkage; Guiding a body through Two distinct positions; Guiding a body through Three distinct positions; The Rotocenter triangle ; Guiding a body through Four distinct positions; Burmester curve.

UNIT - V

INTRODUCTION TO SYNTHESIS-GRAPHICAL METHODS - II: Function generation- General discussion; Function generation: Relative –rotocenter method, Overlay's method, Function generation- Velocity – pole method; Path generation: Hrones's and Nelson's motion Atlas, Roberts's theorem.

UNIT - VI

INTRODUCTION TO SYNTHESIS - ANALYTICAL METHODS: Function Generation: Freudenstien's equation, Precision point approximation, Precision – derivative approximation; Path Generation: Synthesis of Four-bar Mechanisms for specified instantaneous condition; Method of components; Synthesis of Four-bar Mechanisms for prescribed extreme values of the angular velocity of driven link; Method of components.

UNIT -VII

MANIPULATOR KINEMATICS - I: D-H notation, D-H convention of assignment of co-ordinate frames and link parameters table; D-H transformation matrix ; Direct and Inverse kinematic analysis of Serial manipulators: Articulated ,spherical & industrial robot manipulators- PUMA, SCARA,STANFORD ARM, MICROBOT.

UNIT - VIII

MANIPULATOR KINEMATICS - II: Differential kinematics Formulation of Jacobian for planar serial manipulators and spherical manipulator; Singularity analysis.

TEXT BOOKS:

1. John Joseph Uicker; Gordon R Pennock; Joseph Edward Shigley (2011), *Theory of machines and mechanisms,* 4th Edition, Oxford University Press, New York, USA.
2. Lorenzo Sciavicco, Bruno Siciliano (2005), *Modelling and control of Robot manipulators*, 2nd Edition, Springer, London, UK.
3. Bruno Siciliano; Lorenzo Sciavicco; Luigi Villani; Giuseppe Oriolo; et al (2010), *Robotics : Modelling, Planning and Control,* 1st Edition, Springer, London, UK.

REFERENCE BOOKS:

1. Jeremy Hirschhorn (1962), *Kinematics and Dynamics of plane mechanisms*,1st Edition, McGraw-Hill, New York, USA.
2. Crane Carl D.III, Joseph Duffy, Carl D. CraneIII (2008), *Kinematic Analysis of Robot Manipulators*,1st Edition, Cambridge University Press, New York, USA.
3. Reza N. Jazar (2010), *Theory of Applied Robotics : kinematics, dynamics, and control,*2nd Edition, Springer, New York, USA.

M. Tech. ED I SEMESTER

FINITE ELEMENT METHODS

Course Code: **B1704**

L	P	C
3	-	3

UNIT - I

FORMULATION TECHNIQUES: Methodology, Engineering problems and Governing differential equations , Finite elements, Variational methods: Potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and Weighted residual methods, calculus of variations, Essential and Natural boundary conditions.

UNIT - II

ONE-DIMENSIONAL FINITE ELEMENT METHODS: Bar elements, temperature effects. Element matrices, Assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection problems. Examples: - one dimensional fin.

UNIT - III

TRUSSES: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, temperature effects.

UNIT - IV

BEAMS AND FRAMES: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

UNIT - V

TWO DIMENSIONAL PROBLEMS: CST, LST, Four noded and Eight nodded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin.

UNIT - VI

ISOPARAMETRIC FORMULATION: Concepts, Sub parametric, Super parametric elements, Numerical integration.

UNIT - VII

FINITE ELEMENTS IN STRUCTURAL DYNAMICS: Dynamic equations, Eigen value problems, and their solution methods, simple problems.

UNIT - VIII

CONVERGENCE: Requirements for Convergence, H-refinement and P-refinement, complete and incomplete interpolation functions, Pascal's triangle.

TEXT BOOKS:

1. O. C. Zienkiewicz, Richard Lawrence Taylor (2005), *The Finite Element Method,* 6th edition, Elsevier / Butterworth-Heinemann, New York, USA.
2. Singiresu S. Rao (2012), *The Finite Element Method In Engineering*, 5th Edition, Elsevier/ Butterworth-Heinemann, Burlington, USA.

REFERENCE BOOKS:

1. Junuthula Narasimha Reddy, David K. Gartling (2010), *The Finite Element Method In Heat Transfer and Fluid Dynamics,* 3rd edition, CRC Press/Taylor & Francis Group, Boca Raton, USA.
2. J. Tinsley Oden (2006), *Finite Element of Nonlinear continua,* 1st edition, Dover Publications, Mineola, New York, USA.

M. Tech. ED I SEMESTER

MECHATRONICS SYSTEM DESIGN

(Professional Elective - I)

Course Code: **B1705**

L	P	C
3	-	3

UNIT - I

INTRODUCTION: Definition and Introduction to Mechatronic Systems. Modeling and Simulation of Physical systems, Overview of Mechatronic Products and their functioning, Measurement systems. Control Systems, Simple Controllers.

UNIT - II

STUDY OF SENSORS AND TRANSDUCERS: Pneumatic and Hydraulic Systems, Mechanical Actuation System, Electrical Actual Systems, Real time interfacing and Hardware components for Mechatronics.

UNIT - III

ELECTRICAL ACTUATION SYSTEMS: Electrical systems, Mechanical switches, Solid state switches, solenoids, DC & AC motors, Stepper motors.

UNIT - IV

SYSTEM MODELS: *Mathematical models*: Mechanical system building blocks, Electrical system building blocks, Thermal system building blocks, electromechanical systems, Hydro-mechanical systems, Pneumatic systems.

UNIT - V

SIGNAL CONDITIONING: Signal conditioning, the operational amplifier, Protection, Filtering, Wheatstone Bridge, Digital signals , Multiplexers, Data Acquisition, Introduction to digital system processing, pulse-modulation.

UNIT - VI

MEMS AND MICROSYSTEMS: Introduction, Working Principle, Materials for MEMS and Microsystems, Micro System fabrication process, Overview of Micro Manufacturing, Micro system Design, and Micro system Packaging.

UNIT - VII

DATA PRESENTATION SYSTEMS: Basic System Models, System Models, Dynamic Responses of System.

UNIT - VIII

ADVANCED APPLICATIONS IN MECHATRONICS: Fault Finding, Design, Arrangements and Practical Case Studies, Design for Manufacturing, User-friendly Design.

TEXT BOOKS:

1. W. Bolton (2012), *Mechatronics : A Multidisciplinary Approach*, 4th Edition, Pearson Education, New Delhi.
2. Tai-Ran Hsu (2008), *Mems and Microsystems : Design, Manufacture, and Nanoscale Engineering,* 2nd Edition, John Wiley & Sons, Hoboken, New Jersey.

REFERENCE BOOKS:

1. Lawrence J. Kamm (1996), *Understanding Electro-Mechanical Engineering: An Introduction to Mechatronics*, 2nd Edition, Institute of Electrical and Electronics Engineers, New York, USA.
2. Devdas Shetty, Richard A. Kolk (2011), *Mechatronics System Design*, 2nd Edition, Cengage Learning, Stamford, USA.
3. Mahalik (2009), *Mechatronics : Principles, Concepts and Applications,* 1st Edition, Tata McGraw-Hill Education Private Limited, New Delhi.

M. Tech. ED I SEMESTER

FRACTURE, FATIGUE AND CREEP DEFORMATION

(Professional Elective - I)

Course Code: **B1706**

L	P	C
3	-	3

UNIT - I

INTRODUCTION: Prediction of mechanical failure. Macroscopic failure modes; brittle and ductile behavior. Fracture in brittle and ductile materials – characteristics of fracture surfaces; intergranular and intra-granular failure, cleavage and micro-ductility, growth of fatigue cracks, the ductile/brittle fracture transition temperature for notched and un notched components. Fracture at elevated temperature.

UNIT - II

GRIFFITHS ANALYSIS: Concept of energy release rate, G, and fracture energy, R. Modification for ductile materials, loading conditions. Concept of R curves.

UNIT - III

LINEAR ELASTIC FRACTURE MECHANICS (LEFM) - I: Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor.

UNIT - IV

LINEAR ELASTIC FRACTURE MECHANICS (LEFM) - II: The effect of Constraint, definition of plane stress and plane strain and the effect of component thickness. The plasticity at the crack tip and the principles behind the approximate derivation of plastic zone shape and size. Limits on the applicability of LEFM.

UNIT - V

ELASTIC-PLASTIC FRACTURE MECHANICS (EPFM) - I: The definition of alternative failure prediction parameters, Crack Tip Opening Displacement, and the J integral. Measurement of parameters and examples of use.

UNIT - VI

ELASTIC-PLASTIC FRACTURE MECHANICS (EPFM) - II: The effect of Microstructure on fracture mechanism and path, cleavage and ductile failure, factors improving toughness.

UNIT - VII

FATIGUE: Definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, mean stress R ratio, strain and load control. S-N curves. Goodmans rule and Miners rule. Micro mechanisms of fatigue damage, fatigue limits and initiation and propagation control, leading to a consideration of factors enhancing fatigue resistance. Total life and damage tolerant approaches to life prediction.

UNIT - VIII

CREEP DEFORMATION: The evolution of creep damage, primary, secondary and tertiary creep. Micro mechanisms of creep in materials and the role of diffusion. Ashby creep deformation maps. Stress dependence of creep – power law dependence. Comparison of creep performance under different conditions – extrapolation and the use of Larson-Miller parameters. Creep-fatigue interactions. Examples.

TEXT BOOKS:

1. T. L. Anderson (2005), *Fracture Mechanics: Fundamentals and Applications*, 3rd Edition, Taylor & Francis/CRC Press, Boca Raton, USA.
2. Brian Lawn (1998*), Fracture of Brittle Solids*, 2nd Edition, Cambridge University Press, New York, USA.

REFERENCE BOOKS:

1. M. Janssen, J. Zuidema, R. J. H. Wanhill (2004), *Fracture mechanics,* 2nd Edition*,* Spon Press, New York, USA
2. J. F. Knott (1981), *Fundamentals of Fracture Mechanics*, Reprint Edition, Butterworths, London, UK.
3. J. F. Knott, P. Withey (1993), *Worked examples in Fracture Mechanics*, 2nd Edition, Institute of Materials, London, UK.

M. Tech. ED I SEMESTER

TRIBOLOGY AND BEARING DESIGN

(Professional Elective - I)

Course Code: **B1707**

L	P	C
3	-	3

UNIT - I

INTRODUCTION TO TRIBOLOGY: Introduction, Friction, Wear, Wear Characterization, Regimes of lubrication, Classification of contacts, lubrication theories. Newton's Law of viscous forces, Effect of Pressure and Temperature on viscosity.

UNIT - II

HYDRODYNAMIC LUBRICATION: Newton's Law of viscous forces, Flow through stationary parallel plates. Hagen's poiseuille's theory, viscometers. Numerical problems, Concept of lightly loaded bearings, Petroff's equation, Numerical problems.

UNIT - III

HYDRODYNAMIC BEARINGS: Pressure development mechanism. Converging and diverging films and pressure induced flow. Reynold's 2D equation with assumptions. Introduction to idealized slide bearing with fixed shoe and Pivoted shoes. Expression for load carrying capacity. Location of center of pressure, Numerical problems.

UNIT - IV

JOURNAL BEARINGS: Introduction to idealized full journal bearings. Load carrying capacity of idealized full journal bearings, Sommerfeld number and its significance. Comparison between lightly loaded and heavily loaded bearings, Numerical problems.

UNIT - V

EHL CONTACTS: Introduction to Elasto – hydrodynamic lubricated bearings. Introduction to 'EHL' constant. Grubin type solution. Introduction to gas lubricated bearings. Governing differential equation for gas lubricated bearings.

UNIT - VI

HYDROSTATIC BEARINGS: Types of hydrostatic Lubrication systems Expression for discharge, load carrying capacity, Flow rate, Condition for minimum power loss. Torque calculations. Numerical problems.

UNIT - VIII

POROUS AND GAS BEARINGS: Introduction to porous bearings. Equations for porous bearings and working principal, Fretting phenomenon and it's stages.

UNIT - VIII

MAGNETIC BEARINGS: Introduction to magnetic bearings, Active magnetic bearings. Different equations used in magnetic bearings and working principal. Advantages and disadvantages of magnetic bearings, Electrical analogy, Magneto-hydrodynamic bearings.

TEXT BOOKS:

1. Mujamdar B. C (2010), *Introduction to Tribology of Bearings*, 23rd Edition, S. Chand Publisher, New Delhi.
2. Michael M. Khonsari, E. Richard Booser(2008), *Applied Tribology Bearing Design and Lubrication,* 2nd Edition, John Wiley, New York, USA.
3. Susheel Kumar Srivasthava(2004), *Tribology In Industr,* 1st Edition, S. Chand Publisher, New Delhi, India.

REFERENCE BOOKS:

1. Dudley D. Fuller (1984), *Theory and practice of Lubrication for Engineers,* 2nd Edition, John Wiley, New York, USA.
2. Desmond F. Moore (1975), *Principles and applications of Tribology*, 1st Edition, Pergamon press, New York, USA.
3. Yukio Hori (2006), *Hydrodynamic Lubrication*, 1st Edition, Springer, New York, USA.

M. Tech. ED I SEMESTER

MECHANICS OF COMPOSITE MATERIALS

(Professional Elective - II)

Course Code: **B1708**

L	P	C
3	-	3

UNIT - I

INTRODUCTION TO COMPOSITE MATERIALS: Introduction ,Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber- Reinforced Composites and Nature-made Composites and applications .

UNIT - II

REINFORCEMENTS: Fibres, Glass, Silica, Kevlar, carbon, boron, silicon carbide, and boron carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and Ceramic composites.

UNIT - III

MANUFACTURING METHODS: Autoclave, Tape production, Moulding Methods, Filament winding, Man layup, Pultrusion, RTM.

UNIT - IV

MACROMECHANICAL ANALYSIS OF A LAMINA - I: Introduction, Definitions: Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two- Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT - V

MACROMECHANICAL ANALYSIS OF A LAMINA - II: Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina Strength Failure Theories of an Angle Lamina: Maximum Stress Failure Theory Strength Ratio, Failure Envelopes, Maximum Strain Failure Theory, Tsai–Hill Failure Theory, Tsai–Wu Failure Theory, Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress–Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress–Strain Relationships for an Angle Lamina.

UNIT - VI

MACROMECHANICAL ANALYSIS OF A LAMINA - III: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi- Empirical Models ,Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion.

UNIT - VII

MACRO MECHANICAL ANALYSIS OF LAMINATES: Introduction, Laminate Code, Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate, Hygrothermal Effects in a Laminate, Warpage of Laminates

UNIT - VIII

FAILURE, ANALYSIS, AND DESIGN OF LAMINATES: Introduction , Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite, Other Mechanical Design Issues.

TEXT BOOKS:

1. Isaac M. Daniel, Ori Ishai (2006), *Engineering Mechanics of Composite Materials*, 2nd Edition, Oxford University Press, New York, USA.
2. Bhagwan Dass Agarwal, Lawrence J. Broutman, K. Chandrashekhara (2006), *Analysis and Performance of Fiber Composites,* 3rd Edition, Wiley & Sons, Hoboken, New Jersey, USA.
3. Autar K. Kaw (2006), *Mechanics of Composite Materials,* 2nd Edition, CRC/ Taylor & Francis, Boca Raton, USA.

REFERENCE BOOKS:

1. Robert M. Jones (2006), *Mechanics of Composite Materials*, 2nd Edition, Taylor & Francis, New York, USA.
2. G. Narayana Naik(2012), *Development and Design Optimization of Laminated Composite Structures,* 1st Edition, Lap Lambert Academic Publishing, Germany.

M. Tech. ED I SEMESTER

DESIGN FOR MANUFACTURING

(Professional Elective - II)

Course Code: **B1709**

L	P	C
3	-	3

UNIT - I

EFFECT OF MATERIALS AND MANUFACTURING PROCESS ON DESIGN: Major phases of design. Effect of material properties on design effect of manufacturing processes on design. Material selection process- cost per unit property, weighted properties and limits on properties methods.

UNIT - II

TOLERENCE ANALYSIS: Process capability, Mean, Variance, Skewness ,Kurtosis, Process capability metrics, Cp, Cpk, Cost aspects, Feature tolerances, Geometries tolerances, Geometric tolerances, Surface finish, Review of relationship between attainable tolerance grades and different machining process. Cumulative effect of tolerance-Sure fit law and truncated normal law.

UNIT - III

SELECTIVE ASSEMBLY: Interchangeable part manufacture and selective assembly, Deciding the number of groups - Model-1 : Group tolerance of mating parts equal, Model total and group tolerances of shaft equal. Control of axial play-Introducing secondary machining operations, laminated shims, examples.

UNIT - IV

DATUM FEATURES: Functional datum, Datum for manufacturing, changing the datum. Examples.

UNIT - V

DESIGN CONSIDERATIONS: Design of components with casting consideration. Pattern, Mould, and Parting line. Cored holes and Machined holes. Identifying the possible and probable parting line. Casting requiring special sand cores. Designing to obviate sand cores.

UNIT - VI

COMPONENT DESIGN: Component design with machining considerations link design for turning components-milling, Drilling and other related processes including finish- machining operations.

UNIT - VII

TRUE POSITIONAL THEORY: Comparison between co-ordinate and convention method of feature location. Tolerance and true position tolerancing virtual size concept, Floating and fixed fasteners. Projected tolerance zone. Assembly with gasket, zero position tolerance. Functional gauges, Paper layout gauging.

UNIT - VIII

DESIGN OF GAUGES: Design of gauges for checking components in assemble with emphasis on various types of limit gauges for both hole and shaft.

TEXT BOOKS:

1. M. F. Ashby (2011), *Materials Selection in Mechanical Design,* 4th Edition, Elsevier, Amsterdam.
2. Chitale Gupta (2011), *Product Design and Manufacturing,* 5th Edition, PHI Learning, India.
3. G. Boothroyd, Peter Dewhurst, W. A. Knight (2011), *Product Design for Manufacture and Assembly,* 3rd Edition, CRC Press, Boca Raton, USA.

REFRENCE BOOKS:

1. Daniel E. Whitney (2004)**,** *Mechanical Assemblies: Their Design, Manufacture, and Role in Product Development,* 1st Edition**,** Oxford University Press, New York, USA.
2. George Ellwood Dieter (2008), *Engineering Design: A Materials and Processing Approach*, 4th Edition, Mc-Graw Hill, New York, USA.
3. R. K. Jain (2009), *Engineering Metrology*, 20th Edition, Khanna Publications, New Delhi, India.

M. Tech. ED I SEMESTER

THEORY OF ELASTICITY
(Professional Elective - II)

Course Code: **B17T10**

L	P	C
3	-	3

UNIT - I

INTRODUCTION: Definition and Notation for forces and Stresses. Components of stresses, Equations of Equilibrium, Specification of stress at a point. Principal stresses and Mohr's diagram in three dimensions. Boundary conditions .Stress components on an arbitrary plane, Stress invariants, Octahedral stresses, Decomposition of state of stress, Stress transformation.

UNIT - II

INTRODUCTION TO STRAIN : Deformation**,** Strain Displacement relations, Strain components, The state of strain at a point, Principal strain, Strain transformation, Compatibility equations, Cubical dilatation.

UNIT - III

STRESS -STRAIN RELATIONS AND THE GENERAL EQUATIONS OF ELASTICITY: Generalized Hooke's; law in terms of engineering constants. Formulation of. Elasticity Problems. Existence and uniqueness of solution, Saint -Venant's principle, Principle of super position and reciprocal theorem.

UNIT - IV

TWO DIMENSIONAL PROBLEMS IN CARTESIAN CO-ORDINATES: Airy's stress function, investigation for simple beam problems. Bending of a narrow cantilever beam under end load, simply supported beam with uniform load, Use of Fourier series to solve two dimensional problems.

UNIT - V

TWO DIMENSIONAL PROBLEMS IN POLAR CO-ORDINATES: General equations, stress distribution symmetrical about an axis, Pure bending of curved bar, Strain components in polar co-ordinates, Rotating disk and cylinder, Concentrated force on semi-infinite plane, Stress concentration around a circular hole in an infinite plate.

UNIT - VI

THERMAL STRESSES: Introduction, Thermo-elastic stress -strain relations, thin circular disc, long circular cylinder.

UNIT - VII

TORSION OF PRISMATIC BARS: Torsion of Circular and elliptical cross section bars, Soap film analogy, Membrane analogy, Torsion of thin walled open and closed tubes.

UNIT - VIII

ELASTIC STABILITY: Axial compression of prismatic bars, Elastic stability, buckling load for column with constant cross section.

TEXT BOOKS:

1. Arthur P. Boresi, Richard J. Schmidt (2009), *Advanced Mechanics of Materials,* 6th Edition, Wiley India Ltd, New Delhi, India.
2. Stephan Timoshenko, J. N. Goodier (2010), *Theory of elasticity*, 3rd Edition ,Tata McGraw- Hill Education Private Limited, New Delhi, India.

REFERENCE BOOKS:

1. Jacob Pieter Den Hartog (1987), *Advanced strength of materials*, New Edition, Dover Publications, New York.
2. Ansel C. Ugural, Saul K. Fenster (2011), *Advanced Mechanics of Materials and Applied Elasticity*, 5th Edition, Prentice Hall, New Delhi, India.
3. Aldo Maceri (2010), *Theory of Elasticity,* 1st Edition, Springer, New York, USA.
4. Sadd Martin H (2009), *Elasticity: Theory, Applications and Numerics*, 2nd Edition, Academic Press, New York.
5. Sadhu Singh (2009), *Strength of Materials,* 10th Edition, Khanna Publishers, New Delhi.

M. Tech. ED I SEMESTER

SIMULATION LAB

Course Code: **B1711**

L	P	C
-	3	2

LIST OF EXPERIMENTS:

I. MODELING

1. Surface modeling
2. Solid modeling
3. Drafting
4. Assembling

II. STRUCTURAL ANALYSIS USING ANY FEA PACKAGE for different structures that can be discretised with 1-D,2-D & 3-D elements

1. Static Analysis
2. Modal Analysis
3. Harmonic Analysis
4. Spectrum Analysis
5. Buckling Analysis
6. Analysis of Composites
7. Fracture mechanics

III. THERMAL ANALYSIS USING ANY FEA PACKAGE for different structures that can be discretised with 1-D,2-D & 3-D elements

1. Steady state thermal analysis
2. Transient thermal analysis

IV. TRANSIENT ANALYSIS USING ANY FEA PACKAGE for different structures that can be discretised with 1-D,2-D & 3-D elements

1. Linear
2. Non-Linear (Geometrical Non-linearity)

REFERENCE SOFTWARES:

MAT LAB/ ANSYS/ PRO- E & CATIA/HYPERWORKS/ADAMS etc... Design Related Software.

SYLLABAI FOR II SEMESTER

M. Tech. ED II SEMESTER

ROBOTICS

Course Code: **B1713**

L	P	C
3	-	3

UNIT - I

INTRODUCTION AND MATHEMATICAL REPRESENTATION OF ROBOTS: History of Robots, Types of Robots, Notation, Position and Orientation of a Rigid Body, Some Properties of Rotation Matrices, Successive Rotations, Representation by X-Y-Z, Z-Y-Z Euler Angles, Transformation between coordinate system, Homogeneous coordinates, Properties of Types of Joints: Rotary, Prismatic joint, Cylindrical joint, Spherical joint, Representation of links using Denvit-Hartenberg parameters: Link parameters for intermediate, first and last links, Link transformation matrices, Transformation matrices of 3R manipulator, PUMA560 manipulator, SCARA manipulator, The planar four bar mechanisms, Three DOF parallel manipulator, A six- DOF parallel(hybrid) manipulator.

UNIT - II

KINEMATICS OF SERIAL AND PARALLEL MANIPULATORS: Degrees of freedom of a manipulator, Loop constraint equations. Direct kinematics of 2R and 3R manipulator, Puma560 manipulator, SCARA manipulator, Stanford arm, Planar four bar mechanism, Direct kinematics of Stewart-Gough Platform. Inverse kinematics of 2R, 3R manipulator, Inverse kinematics of Stewart-Gough Platform.

UNIT - III

VELOCITY AND STATICS OF MANIPULATORS: Differential relationships, Jacobian, Differential motions of a frame (translation and rotation), Linear and angular velocity of a rigid body, Linear and angular velocities of links in serial manipulators, 2R, 3R manipulators, Jacobian of serial manipulator, Three DOF parallel manipulator Velocity ellipse of 2R manipulator, Singularities of serial and parallel manipulators 2R, 3R, four bar mechanism, three DOF parallel manipulator, Statics of serial manipulators, Static force and torque analysis of 3R manipulator, Statics of parallel manipulator, Singularity in force domain.

UNIT - IV

DYNAMICS OF MANIPULATORS: Inertia of a link, Recursive formulation of Dynamics using Newton Euler equation, Equation of motion of 2R and 3R manipulators using Lagrangian, Newton-Euler formulation.

UNIT - V

TRAJECTORY PLANNING: Joint space schemes, cubic trajectory, Joint space schemes with via points, Cubic trajectory with a via point, Third order polynomial trajectory planning, Linear segments with parabolic blends, Cartesian space schemes, Cartesian straight line and circular motion planning, Trajectory planning for orientation.

UNIT - VI

CONTROL: Feedback control of a single link manipulator- first order, second order system, PID control, PID control of multi link manipulator, Non-linear control of manipulators-computed torque method, Force control of manipulator, Cartesian control of manipulators, Force control of manipulators-force control of single mass, Partitioning a task for force and position control- lever, peg in hole Hybrid force and position controller.

UNIT - VII

ACTUATORS: Types, Characteristics of actuating system: weight, Power-to-weight ratio, Operating pressure, Stiffness vs. compliance, Use of reduction gears, Comparision of hydraulic, Electric, pneumatic, actuators, Hydraulic actuators, Proportional feedback control, Electric Motors: DC motors, Reversible AC motors, Brushles DC motors, Stepper motors- structure and principle of operation, Stepper motor speed-torque characteristics.

UNIT - VIII

SENSORS: Sensor characteristics, Position sensors- potentiometers, Encoders, LVDT, Resolvers, Displacement sensor, Velocity sensor- encoders, tachometers, Acceleration sensors, Force and Pressure sensors - piezoelectric, force sensing resistor, Torque sensors, Touch and tactile sensor, Proximity sensors-magnetic, Optical, Ultrasonic, Inductive, Capacitive, Eddy-current proximity sensors.

TEXT BOOKS:

1. Ashitava Ghosal (2009), *Robotics: Fundamental Concepts and Analysis*, 1st Edition, Oxford University Press, New Delhi, India.
2. Saeed B. Niku (2011), *Introduction To Robotics: Analysis, Control, Applications,* 2nd Edition, Wiley India Pvt Ltd, New Delhi, India.

REFERENCE BOOKS:

1. John J. Craig (2010), *Introduction to Robotics: Mechanics and Control*, 3rd Edition, Pearson Education, New Delhi, India.
2. Schilling J. Robert (2009), *Fundamentals of Robotics, Analysis and Control*, 1st Edition, Prentice Hall of India, New Delhi, India.

M. Tech. ED II SEMESTER

MECHANICAL VIBRATIONS

Course Code: **B1714**

L	P	C
3	-	3

UNIT - I

SINGLE DEGREE OF FREEDOM SYSTEMS - I: Undamped and Damped free vibrations: forced vibrations ; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation; Vibration isolation and transmissibility.

UNIT - II

SINGLE DEGREE OF FREEDOM SYSTEMS - II: Response to Non Periodic Excitations: unit Impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

UNIT - III

VIBRATION MEASURING INSTRUMENTS: Vibrometers, velocity meters & accelerometers.

UNIT - IV

TWO DEGREE FREEDOM SYSTEMS: Principal modes, undamped and damped free and forced vibrations, undamped vibration absorbers.

UNIT - V

MULTI DEGREE FREEDOM SYSTEMS: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems; Discrete-Time systems.

UNIT - VI

NUMERICAL METHODS: Rayliegh's, stodola's, Matrix iteration, Rayleigh-Ritz Method and Holzer's methods.

UNIT - VII

CONTINUOUS SYSTEMS: Free vibration of strings – longitudinal oscillations of bars-traverse vibrations of beams-Torsional vibrations of shafts.

UNIT - VIII

CRITICAL SPEEDS OF SHAFTS: Critical speeds without and with damping, secondary critical speed.

TEXT BOOKS:

1. Meirovitch (2006), *Elements of Vibration Analysis*, 2nd Edition (SIE), Tata McGraw Hill, New Delhi, India.
2. G. K. Grover (2009), *Mechanical Vibrations*, 8th Edition, Nem Chand & Bros, Roorkee, India.

REFERENCE BOOKS:

1. Amy L. Galloway (2011), *Mechanical Vibrations: Types, Testing, and Analysis*, 1st Edition, Nova Science Publishers, New York, USA.
2. Stephen Timoshenko (2011), *Vibration problems in Engineering,* 2nd Edition, Oxford City Press, New York, USA.

M. Tech. ED II SEMESTER

ADVANCED OPTIMIZATION TECHNIQUES

Course Code: **B1715**

L	P	C
3	-	3

UNIT - I

LINEAR PROGRAMMING: Two-phase simplex method, Big-M method, duality, interpretation, applications.

UNIT - II

ASSIGNMENT PROBLEM: Hungarian's algorithm, Degeneracy, applications, unbalanced problems, Traveling salesman problem.

UNIT - III

CLASSICAL OPTIMIZATION TECHNIQUES: Single variable optimization with and without constraints, multi - variable optimization without constraints, multi - variable optimization with constraints - method of Lagrange multipliers, Kuhn-Tucker conditions.

UNIT - IV

NUMERICAL METHODS FOR OPTIMIZATION: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT - V

GENETIC ALGORITHM (GA): Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA.

UNIT - VI

GENETIC PROGRAMMING (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT - VII

MULTI-OBJECTIVE GA: Pareto's analysis, Non-dominated front, multi - objective GA, Nondominated sorted GA, convergence criterion, applications of multi-objective problems.

UNIT - VIII

APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

TEXT BOOKS:

1. Jasbir S. Arora (2007), *Optimization of structural and mechanical systems***,** 1st Edition, World Scientific, Singapore.
2. Kalyanmoy Deb (2009), *Optimization for Engineering Design: Algorithms and Examples*, 1st Edition, Prentice Hall of India, New Delhi, India.
3. Singiresu S. Rao (2009), *Engineering Optimization: Theory and Practice,* 4th Edition*,* John Wiley & Sons, New Delhi, India.

REFERENCE BOOKS:

1. D. E. Goldberg (2006), *Genetic algorithms in Search, Optimization, and Machine learning,* 28th Print, Addison- Wesley Publishers, Boston, USA.
2. W. B. Langdon, Riccardo Poli (2010), *Foundations of genetic programming,* 1st Edition, Springer, New York.
3. R. Venkata Rao, Vimal J. Savsani (2012), *Mechanical Design Optimization Using Advanced Optimization Techniques,* 1st Edition, Springer, New York.

M. Tech. ED II SEMESTER

GEAR ENGINEERING

Course Code: **B1716**

L	P	C
3	-	3

UNIT - I

INTRODUCTION: Principles of gear tooth action, Generation of Cycloid and Involute gears, Involutometry, gear manufacturing processes and inspection, gear tooth failure modes, stresses, selection of right kind of gears.

UNIT - II

SPUR GEARS: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of spur gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

UNIT - III

HELICAL GEARS: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of helical gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

UNIT - IV

BEVEL GEARS: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of bevel gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft and bearings.

UNIT - V

WORM GEARS: Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of worm gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Heat dissipation considerations. Design of gear shaft and bearings.

UNIT - VI

GEAR FAILURES: Analysis of gear tooth failures, Nomenclature of gear tooth wear and failure, tooth breakage, pitting, scoring, wear, overloading, gear- casing problems, lubrication failures.

UNIT - VII

GEAR TRAINS: Simple, compound and epicyclic gear trains, Ray diagrams, Design of a gear box of an automobile, Design of gear trains from the propeller shafts of airplanes for auxiliary systems.

UNI T - VIII

OPTIMAL GEAR DESIGN: Optimization of gear design parameters, Weight minimization, Constraints in gear train design-space, interference, strength, dynamic considerations, rigidity etc. Compact design of gear trains, multi objective optimization of gear trains. Application of Traditional and non-traditional optimization techniques.

TEXT BOOKS:

1. O. P. Grover (2011), *Maleev & Hartman's Machine Design*, 5th Edition, C.B.S. Publishers, India.
2. Darle W. Dudley, S. P. Radzevich (2012), *Dudley's Handbook of Practical Gear Design and Manufacture*, 10th Edition, CRC Press, Boca Raton, USA.

REFERENCE BOOKS:

1. Earle Buckingham (2011), *Analytical Mechanics of Gears*, 6th Edition, Dover publications, New York, USA.
2. G. M. Maitha (2001), *Handbook of Gear Design*, McGraw-Hill, New Delhi, India.
3. Richard G. Budynas, J. Keith Nisbett, Joseph Edward Shigley (2011), *Shigley's Mechanical Engineering Design*, 9th Edition, McGraw-Hill, New York, USA.

M. Tech. ED II SEMESTER

COMPUTER APPLICATIONS IN DESIGN

(Professional Elective - III)

Course Code: **B1717**

L	P	C
3	-	3

UNIT - I

INTRODUCTION TO CAD/CAM/CAE SYSTEMS: Overview, Definitions of CAD. CAM and CAE, Integrating the Design and Manufacturing Processes through a Common Database-A Scenario, Using CAD/CAM/CAE Systems for Product Development-A Practical Example.

UNIT - II

COMPONENTS OF CAD/CAM/CAE SYSTEMS: Hardware Components, Vector-Refresh (Stroke-Refresh) Graphics Devices, Raster Graphics Devices, Hardware Configuration, Software Components, Windows-Based CAD Systems.

UNIT - III

BASIC CONCEPTS OF GRAPHICS PROGRAMMING: Graphics Libraries, Coordinate Systems, Window and Viewport, Output Primitives - Line, Polygon, Marker Text, Graphics Input, Display List, Transformation Matrix, Translation, Rotation, Mapping, Other Transformation Matrices, Hidden-Line and Hidden-Surface Removal, Back-Face Removal Algorithm, Depth-Sorting, or Painter.s, Algorithm, Hidden-Line Removal Algorithm, z-Buffer Method, Rendering, Shading, Ray Tracing, Graphical User Interface, X Window System.

UNIT - IV

GEOMETRIC MODELING SYSTEMS: Wireframe Modeling Systems, Surface Modeling Systems, Solid Modeling Systems, Modeling Functions, Data Structure, Euler Operators, Boolean Operations, Calculation of Volumetric Properties, Nonmanifold Modeling Systems, Assembly Modeling Capabilities, Basic Functions of Assembly Modeling, Browsing an Assembly, Features of Concurrent Design, Use of Assembly models, Simplification of Assemblies, Web-Based Modeling.

UNIT - V

REPRESENTATION AND MANIPULATION OF CURVES: Types of Curve Equations, Conic Sections, Circle or Circular Arc, Ellipse or Elliptic Arc, Hyperbola, Parabola, Hermite Curves, Bezier Curve, Differentiation of a Bezier Curve Equation, Evaluation of a Bezier Curve, B-Spline Curve, Evaluation of a B-Spline Curve, Composition of B-Spline Curves, Differentiation of a B-Spline Curve, Nonuniform Rational B-Spline (NURBS) Curve, Evaluation of a NURBS Curve, Differentiation of a NURBS Curve, Interpolation Curves, Interpolation Using a Hermite Curve, Interpolation Using a B-Spline Curve, Intersection of Curves.

UNIT - VI

REPRESENTATION AND MANIPULATION OF SURFACES: Types of Surface Equations, Bilinear Surface, Coon's Patch, Bicubic Patch, Bezier Surface, Evaluation of a Bezier Surface, Differentiation of a Bezier Surface, B-Spline Surface, Evaluation of a-B-Spline Surface, Differentiation of a B-Spline Surface, NURBS Surface, Interpolation Surface, Intersection of Surfaces.

UNIT - VII

CAD AND CAM INTEGRATION: Overview of the Discrete Part Production Cycle, Process Planning, Manual Approach, Variant Approach, Generative Approach, Computer-Aided Process Planning Systems, CAM-I CAPP, MIPLAN and MultiCAPP, MetCAPP, ICEM-PART, Group Technology, Classification and Coding, Existing Coding Systems, Product Data Management (PDM) Systems.

UNIT - VIII

STANDARDS FOR COMMUNICATING BETWEEN SYSTEMS: Exchange Methods of Product Definition Data, Initial Graphics Exchange Specification, Drawing Interchange Format, Standard for the Exchange of Product Data.
Tutorials, Computational exercises involving Geometric Modeling of components and their assemblies.

TEXT BOOKS:

1. Kunwoo Lee (2005), *Principles of CAD/CAM/CAE Systems,* 4th Edition, Prentice Hall of India, New Delhi, India.
2. David D. Bedworth, Mark Richard Henderson, Philip Wolfe (1991), *Computer-Integrated Design and Manufacturing*, 1st Edition, McGraw-Hill, New York, USA.

REFERENCE BOOKS:

1. Ibrahim Zeid(2009), *CAD/CAM: Theory & Practice*, 2nd Edition(SIE), Tata McGraw-Hill Education Private Limited, New Delhi, India.

M. Tech. ED II SEMESTER

COMPUTATIONAL FLUID DYNAMICS

(Professional Elective - III)

Course Code: **B1718**

L	P	C
3	-	3

UNIT - I

INTRODUCTION: Finite difference method, Finite volume method, Finite element method, Governing Equations and boundary conditions. Derivation of finite difference equations.

UNIT - II

SOLUTION METHODS: solution methods of elliptical equations, finite difference formulations, Interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von-Neumann stability analysis, implicit schemes, Alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT - III

HYPERBOLIC EQUATIONS: Explicit Schemes and Von-Neumann stability analysis, implicit schemes, Multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: explicit and implicit schemes, Runge-Kutta method.

UNIT - IV

FORMULATIONS OF IN COMPRESSIBLE VISCOUS FLOWS: Formulations of Incompressible viscous flows by Finite difference methods, Pressure Correction methods, Vortex methods.

UNIT - V

TREATMENT OF COMPRESSIBLE FLOWS: Potential Equation, Eluer Equations, Navier-Stokes system of Equations, flow field-dependent variation methods, boundary conditions, example problems.

UNIT - VI

FINITE VOLUME METHOD: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

UNIT - VII

STANDARD VARIATIONAL METHODS - I: Linear fluid flow problems, Steady state problems.

UNIT - VIII

STANDARD VARIATIONAL METHODS - II: Transient problems.

TEXT BOOK:

1. John D. Anderson (2012), *Computational Fluid Dynamics: The Basics with Applications*, 1st Edition, Tata McGraw -Hill Publisher, New Delhi, India.
2. J. Blazek (2007), *Computational fluid dynamics: principles and applications*, 2nd Edition, Elsevier, Amsterdam, USA.
3. T. J. Chung (2010), *Computational Fluid Dynamics,* 2nd Edition, Cambridge University Press, New York, USA.

REFERENCE BOOK:

1. Harvard Lomax, Thomas H. Pulliam, David W. Zingg (2011), *Fundamentals of Computational Fluid Dynamics,* 2nd Edition, Springer, New York, USA.
2. Chorlton F. (2010), *Text Book of Fluid Dynamics*, 1st Edition, CBS Publishers & Distributors (P) Ltd, New Delhi.

M. Tech. ED II SEMESTER

THEORY OF PLATES
(Professional Elective - III)

Course Code: **B1719**

L	P	C
3	-	3

UNIT - I

BENDING OF LONG RECTANGULAR PLATES TO A CYLINDRICAL SURFACE: Differential equation for cylindrical bending of plates, Cylindrical bending of uniformly loaded rectangular plates with simply supported edges, Cylindrical bending of uniformly loaded rectangular plates with built-in edges.

UNIT - II

PURE BENDING OF PLATES: Slope and curvature of slightly bent plates, Relations between bending moments and curvature in pure bending of plates, Particular cases of pure bending, Strain energy in pure bending of plates.

UNIT - III

SYMMETRICAL BENDING OF CIRCULAR PLATES: Differential equation for symmetrical bending of laterally loaded circular plates, Uniformly loaded circular plates, Circular plate with a circular hole at the center, Circular plate concentrically loaded, Circular plate loaded at the center.

UNIT - IV

SMALL DEFLECTIONS OF LATERALLY LOADED PLATES: The differential equation of the deflection surface, Boundary conditions, Alternate method of derivation of the boundary condition, Reduction of the problem of bending of a plate to that of deflection of a membrane.

UNIT - V

SIMPLY SUPPORTED RECTANGULAR PLATES: Simply supported rectangular plates under sinusoidal load, Navier solution for simply supported rectangular plates.

UNIT - VI

RECTANGULAR PLATES WITH VARIOUS EDGE CONDITIONS: Bending of rectangular plates by moments distributed along the edges - Rectangular plates with two opposite edges simply supported and the other two edges clamped.

UNIT - VII

CONTINUOUS RECTANGULAR PLATES: Simply supported continuous plates, approximate design of continuous plates with equal spans, bending symmetrical with respect to a center.

UNIT - VIII

DEFORMATION OF SHELLS WITHOUT BENDING: Definition and notation, Shells in the form of a surface of revolution and loaded symmetrically with respect to their axis, Particular cases of shells in the form of surfaces of revolution - Shells of constant strength.

GENERAL THEORY OF CYLINDRICAL SHELLS: A circular cylindrical shell loaded symmetrically with respect to its axis, Particular cases of symmetrical deformation of circular cylindrical shells, Pressure vessels.

TEXT BOOKS:

1. Stepan P. Timošenko, Sergius Woinowsky Krieger(2007), *Theory of Plates and Shells*, 2nd Edition, McGraw-Hill, Auckland, USA.
2. K. Chandrashekhara(2001), *Theory of Plates*, 1st Edition, Universities Press Pvt Ltd., Hyderabad.

REFERENCE BOOKS:

1. Ventsel Eduard (2001), *Thin Plates and Shells: Theory, Analysis, and Applications,* 1st Edition, Marcel Dekker, New York, USA.

M. Tech. ED II SEMESTER

PRESSURE VESSEL AND PIPING DESIGN

(Professional Elective - IV)

Course Code: **B1720**

L	P	C
3	-	3

UNIT - I

INTRODUCTION: Materials-shapes of Vessels-stresses in cylindrical, spherical and arbitrary, shaped shells. Cylindrical Vessels subjected to internal pressure, wind load, bending and torque-ilation of pressure vessels-conical and tetrahedral vessels.

UNIT - II

THEORY OF THICK CYLINDERS: Shrink fit stresses in built up cylinders-auto frettage of thick cylinders. Thermal stresses in Pressure Vessels.

UNIT - III

THEORY OF RECTANGULAR PLATES: Pure bending-different edge conditions.

UNIT - IV

THEORY CIRCULAR PLATES: Simple supported and clamped ends subjected to concentrated and uniformly distributed loads-stresses from local loads. Design of dome bends, shell connections, flat heads and cone openings.

UNIT - V

DISCONTINUITY STRESSES IN PRESSURE VESSELS: Introduction, beam on an elastic foundation, infinitely long beam, semi infinite beam, cylindrical vessel under axially symmetrical loading, extent and significance of load deformations on pressure vessels, discontinuity stresses in vessels, stresses in a bimetallic joints, deformation and stresses in flanges.

UNIT - VI

PRESSURE VESSEL MATERIALS AND THEIR ENVIRONMENT: Introduction, ductile material tensile tests, structure and strength of steel, Leuder's lines, determination of stress patterns from plastic flow observations, behaviour of steel beyond the yield point, effect of cold work or strain hardening on the physical properties of pressure vessel steels, fracture types in tension, toughness of materials, effect of neutron irradiation of steels, fatigue of metals, fatigue crack growth, fatigue life prediction, cumulative fatigue damage, stress theory of failure of vessels subject to steady state and fatigue conditions.

UNIT - VII

STRESS CONCENTRATIONS: Influence of surface effects on fatigue, effect of the environment and other factors on fatigue life, thermal stress fatigue, creep and rupture of metals at elevated temperatures, hydrogen embrittlement of pressure vessel steels, brittle fracture, effect of environment on fracture toughness, fracture toughness relationships, criteria for design with defects, significance of fracture mechanics evaluations, effect of warm prestressing on the ambient temperature toughness of pressure vessel steels.

UNIT - VIII

DESIGN FEATURES: Localized stresses and their significance, stress concentration at a variable thickness transition section in a cylindrical vessel, stress concentration about a circular hole in a plate subjected to tension, elliptical openings, stress concentration, stress concentration factors for superposition, dynamic and thermal transient conditions, theory of reinforced openings, nozzle reinforcement, placement and shape, fatigue and stress concentration.

TEXT BOOKS:

1. A. Keith Escoe (1995), *Mechanical Design of Process Systems,* 2nd Edition, Gulf Publishing Co, Huston, USA.
2. Donatello Annaratone(2010), *Pressure Vessel Design,*1st Edition, Springer , New York, USA.

REFERENCE BOOKS:

1. Mahendra Kumar Samal (2011), *Recent Advances in Design & Usage of Pressure Vessels and Piping Components*, 1st Edition, Nova Science Publishers, New Delhi, India.
2. Harvey (2001), *Theory and Design of Pressure Vessels*, 1st Edition, C. B. S. Publishers, New Delhi, India.
3. Pullarcot Sunil (2002), *Practical Guide to Pressure Vessel Manufacturing*, 1st Edition, Marcel Dekker, New York, USA.

M. Tech. ED II SEMESTER

NANO TECHNOLOGY
(Professional Elective - IV)

Course Code: **B1721**

L	P	C
3	-	3

UNIT - I

INTRODUCTION: Introduction Size and Shape dependence of material properties at the nanoscale, why is small good? Limits to smallness, scaling relations, can nanorobots walk and nanoplanes fly? Nanoscale elements in conventional technologies.

UNIT - II

LITHOGRAPHY TECHNIQUES: Top-down and Bottom-up nanofabrication, The Intel-IBM approach to nanotechnology: Lithography, Etching, Ion implantation, Thin film deposition, Electron beam lithography, Soft lithography: nano imprinting and micro contact printing, Solution/Plasma-phase nanofabrication, Sol-gel methods, Template techniques.

UNIT - III

SELF ASSEMBLY: Self assembly and self-organization Functional coatings with self assembled monolayers of molecules and nanoparticles, Langmuir- Blodgett films, layer-by-layer growth.

UNIT - IV

CHARACTERIZATION TECHNIQUES: Imaging / Characterization of nanostructures General considerations for imaging, Scanning Probe Techniques: SEM, STM, AFM, NSOM.

UNIT - V

SYNTHESIS - I: Metal and semiconductor Nanoparticles Synthesis, stability, control of size, Optical and Electronic properties, Ultra-sensitive imaging and detection with Nanoparticles, Bioengineering applications, Catalysis.

UNIT - VI

SYNTHESIS - II: Semiconductor and Metal Nanowires Vapor/liquid/solid growth and other synthesis techniques, Nanowire transistors and sensors.

UNIT - VII

CARBON NANO TUBES: Carbon nanotubes Structure and synthesis, Electronic, Vibrational, and Mechanical properties, how can C nanotubes enable faster computers, brighter TV screens, and stronger mechanical reinforcement?

UNIT - VIII

APPLICATIONS OF NANOTECHNOLOGY: Mechanics at Nanoscale Enhancement of mechanical properties with decreasing size, Nanoelectromechanical systems, Nanomachines, Nanofluidics, Filtration, Sorting, Molecular motors.

TEXT BOOKS:

1. Robert Kelsall, Ian W. Hamley, Mark Geoghegan, Kelsall R. (2006), *Nanoscale Science and Technology* , 2nd Edition, John Wiley Sons ,New York, USA.
2. Massimiliano Di Ventra, Stephane Evoy, James R. Heflin (2004), *Introduction to Nanoscale Science and Technology (With Cd-Rom)*, Springer, New York, USA.

REFERENCE BOOKS:

1. Charles P. Poole, Frank J. Owens (2010), *Introduction to Nanotechnology,* Reprint Edition*,* Wiley India, New Delhi, India.
2. Geoffrey A. Ozin; André C. Arsenault, Ludovico Cademartiri (2009), *Nanochemistry : A Chemical Approach To Nanomaterials,* 2nd Edition*,* RSC Publishing, Cambridge, UK.

M. Tech. ED II SEMESTER

ROBUST DESIGN
(Professional Elective - IV)

Course Code: **B1722**

L	P	C
3	-	3

UNIT - I

QUALITY BY EXPERIMENTAL DESIGN: Quality, western and Taguchi quality philosophy, Elements of cost, Noise factors causes of variation, Quadratic loss function and variation of quadratic loss functions. **Robust Design:** Steps in robust design: parameter design and tolerance design, reliability improvement through experiments, illustration through numerical examples.

UNIT - II

EXPERIMENTAL DESIGN: Classical experiments: factorial experiments, terminology, factors. Levels, Interactions, Treatment combination, randomization, 2-level experimental design for two factors and three factors. 3-level experiment deigns for two factors and three factors, factor effects, factor interactions, Fractional factorial design, Saturated design, Central composite designs, Illustration through numerical examples**.**

UNIT - III

MEASURES OF VARIABILITY: Measures of variability, Concept of confidence level, Statistical distributions: normal, log normal and Weibull distributions. Hypothesis testing, Probability plots choice of sample size illustration through numerical examples.

UNIT - IV

ANALYSIS AND INTERPRETATION OF EXPERIMENTAL DATA: Measures of variability, Ranking method, column effect method and plotting method, Analysis of variance (ANOVA), in factorial experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data, illustration through numerical examples.

UNIT - V

TAGUCHI'S ORTHOGONAL ARRAYS : Types orthogonal arrays, Selection of standard orthogonal arrays, Linear graphs and interaction assignment, dummy level technique, Compound factor method, modification of linear graphs, Column merging method, Branching design, Strategies for constructing orthogonal arrays.

UNIT - VI

SIGNAL TO NOISE RATIO (S-N RATIOS): Evaluation of sensitivity to noise, Signal to noise ratios for static problems, Smaller – the better types, Nominal – the better type, larger – the better type. Signal to noise ratios for dynamic problems, Illustrations through numerical examples.

UNIT - VII

PARAMETER DESIGN AND TOLERANCE DESIGN: Parameter and tolerance design concepts, Taguchi's inner and outer arrays, Parameter design strategy, Tolerance deign strategy, Illustrations through numerical examples**.**

UNIT - VIII

RELIABILITY IMPROVEMENT THROUGH ROBUST DESIGN : Role of S-N ratios in reliability improvement ; Case study; Illustrating the reliability improvement of routing process of a printed wiring boards using robust design concepts.

TEXT BOOKS:

1. Madhav S. Phadake(2008), *Quality Engineering Using Robust Design*,4th Edition, Pearson Education, New York, USA.
2. Sung H. Park, Jiju Antony (2008), *Robust design for quality engineering and Six Sigma*, 1st Edition, World Scientific, Singapore.
3. Phillip J. Ross (2005), *Taguchi Techniques for Quality Engineering,* 2nd Edition, Tata McGraw- Hill Education Private Limited, New Delhi, India.

REFERENCE BOOKS:

1. Douglas C. Montgomery (2012), *Design and Analysis of Experiments,* 8th Edition, Willey India Pvt. Ltd, New Delhi, India.
2. Thomas B. Barker, Barker B. Barker (2005), *Quality by Experimental Design,* 3rd Edition, CRC Press, New York, USA.
3. Michael Hamada C. F. Jeff Wu (2009), *Experiments: Planning, Analysis And Parameter Design Optimization,* 1st Edition, Wiley India Pvt Ltd, New Delhi, India.

M. Tech. ED II SEMESTER

MACHINE DYNAMICS LAB

Course Code: **B1723**

L	P	C
-	3	2

LIST OF EXPERIMENTS:

1. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils
2. Determination of steady state amplitude of a forced vibratory system
3. Static balancing using steel balls
4. Determination of the magnitude and orientation of the balancing mass in dynamic balancing
5. Field balancing of the thin rotors using vibration pickups
6. Determination of the magnitude of gyroscopic couple, angular velocity of precession, and representation of vectors
7. Determination of natural frequency of given structure using FFT analyzer
8. Diagnosis of a machine using FFT analyzer
9. Direct kinematic analysis of a robot
10. Inverse kinematic analysis of a robot
11. Trajectory planning of a robot in joint space scheme
12. Palletizing operation using Robot programming

M. Tech. ED I / II SEMESTER

TECHNICAL SEMINAR

L	T	P	C
-	-	-	2

1. OBJECTIVE:

Seminar is an important component of learning in an Engineering College, where the student gets acquainted with preparing a report & presentation on a topic.

2. **PERIODICITY / FREQUENCY OF EVALUATION: Twice**

3. PARAMETERS OF EVALUATION:

1. The seminar shall have two components, one chosen by the student from the course-work without repetition and approved by the faculty supervisor. The other component is suggested by the supervisor and can be a reproduction of the concept in any standard research paper or an extension of concept from earlier course work.
2. The two components of the seminar are distributed between two halves of the semester and are evaluated for 50 marks each. The average of the two components shall be taken as the final score.
3. The students shall be required to submit the rough drafts of the seminar outputs within one week of the commencement of the class work.
4. Supervisor shall make suggestions for modification in the rough draft. The final draft shall be presented by the student within a week thereafter.
5. Presentation schedules will be prepared by different Departments in line with the academic calendar.

The Seminars shall be evaluated in two stages as follows:

A. Rough draft

In this stage, the student should collect information from various sources on the topic and collate them in a systematic manner. He/ She may take the help of the concerned supervisor.

The report should be typed in “MS-Word” file with “calibri” font, with font size of 16 for main heading, 14 for sub-headings and 11 for the body text. The contents should also be arranged in Power Point Presentation with relevant diagrams, pictures and illustrations. It should normally contain 18 to 25 slides, consisting of the followings:

1.	Topic, name of the student & guide	1 Slide
2.	List of contents	1 Slide
3.	Introduction	1 - 2 Slides
4.	Descriptions of the topic (point-wise)	7 - 10 Slides
5.	Images, circuits etc.	6 - 8 Slides
6.	Conclusion	1 - 2 Slides
7.	References/Bibliography	1 Slide

The soft copy of the rough draft of the seminar presentation in MS Power Point format along with the draft Report should be submitted to the concerned supervisor, with a copy to the concerned HOD within 30 days of the commencement of class work.

The evaluation of the Rough draft shall generally be based upon the following.

1.	Punctuality in submission of rough draft and discussion	**2 Marks**
2.	Resources from which the seminar have been based	**2 Marks**
3.	Report	**3 Marks**
4.	Lay out, and content of Presentation	**3 Marks**
5.	Depth of the students knowledge in the subject	**5 Marks**
Total		**15 Marks**

After evaluation of the first draft the supervisor shall suggest further reading, additional work and fine tuning, to improve the quality of the seminar work.

Within 7 days of the submission of the rough draft, the students are to submit the final draft incorporating the suggestions made by the supervisor.

B. Presentation:

After finalization of the final draft, the students shall be allotted dates for presentation (in the designated seminar classes) and they shall then present it in presence students, supervisor, faculties of the department and at least one faculty from some department / other department.

The student shall submit 3 copies of the Report neatly bound along with 2 soft copies of the PPT in DVD medium. The students shall also distribute the title and abstract of the seminar in hard copy to the audience. The final presentation has to be delivered with 18-25 slides.

The evaluation of the Presentation shall generally be based upon the following.

1.	Contents	**10 Marks**
2.	Delivery	**10 Marks**
3.	Relevance and interest the topic creates	**5 Marks**
4.	Ability to involve the spectators	**5 Marks**
5.	Question answer session	**5 Marks**
TOTAL		**35 Marks**

4. WHO WILL EVALUATE?

The presentation of the seminar topics shall be made before an internal evaluation committee comprising the Head of the Department or his/her nominee, seminar supervisor and a senior faculty of the department / other department.

M. Tech. ED III SEMESTER

COMPREHENSIVE VIVA

Course Code: **B1725**

L	T	P	C
-	-	-	4

1. OBJECTIVE:

- To enable the examiners to assess the candidate's knowledge in his or her particular field of learning.
- To test the student's awareness of the latest developments and relate them to the knowledge acquired during the classroom teaching.

2. PARAMETERS OF EVALUATION:

Subject Knowledge	Current Awareness	Career Orientation	Communication Skills	Total
20	10	10	10	50

3. WHO WILL EVALUATE?

The comprehensive Viva will be conducted by a committee comprising Head of the Department or his/her nominee, two senior faculty of the respective department and an external examiner from outside the college. The comprehensive viva shall be evaluated for 50 marks at the end of III semester. A minimum of 40% of maximum marks shall be obtained to earn the corresponding credits.

4. **PERIODICITY / FREQUENCY OF EVALUATION: Once**

5. PEDAGOGY:

- The viva will be held on a face to face basis.
- The students will be expected to answer the questions related to latest developments and all courses taken till date.
- Viva voce will be conducted within week before the beginning of midterm examinations. However, in exceptional circumstances it can be scheduled immediately after the end of midterm examinations.
- Students will have to make themselves available on the date of the viva voce.

M. Tech. ED III/ IV SEMESTER

PROJECT WORK

1. OBJECTIVE:

The main objective of the Project Work is for the students to learn and experience all the major phases and processes involved in solving "real life engineering problems".

2. EXPECTED OUTCOME:

The major outcome of the M. Tech project must be well-trained students. More specifically students must have acquired:

- System integration skills
- Documentation skills
- Project management skills
- Problem solving skills

3. PROJECT SELECTION:

Projects are suggested by the faculty, with or without collaboration with an industry. All faculty are to suggest projects. Students are also encouraged to give project proposals after identifying a faculty who would be willing to supervisor the work. A Project brief is to be given by the faculty to the group defining the project comprehensively.

All M. Tech major projects are to be done in the Institute. For industry specified projects, students will be permitted to spend 1-2 weeks in the industry on recommendation by the supervisor. The number of students per batch should be 1.

4. WHO WILL EVALUATE?

The end semester examination shall be based on the report submitted and a viva-voce exam for 100 marks by committee comprising of the Head of the Department, project supervisor and an external examiner.

5. EVALUATION:

The basic purpose is to assess the student competencies with regard to his project work. More specifically to assess the student's individual contribution to the project, to establish the level of understanding of basic theoretical knowledge relevant to the project and to ensure that the student has good understanding and appreciation of design and development decisions taken in the course of the project. It is desirable that all faculty members are present for the evaluations as this is a platform to get to know the student projects and to motivate the students to do good projects. The faculty should adopt a clear and consistent pattern of asking questions from general to specific aspects of the project. The presentation and evaluation is open to other students of the department.

The project work shall be evaluated for 150 marks out of which 50 marks for internal evaluation and 100 marks for end-semester evaluation. The evaluation shall be done on the following basis

Semester III	**Semester IV**
Preliminary Evaluation - 50 marks	Design Evaluation I - 25 marks
	Design Evaluation II - 25 marks
	Final Evaluation – 100 marks

6. GUIDELINES FOR THE PREPARATION OF M. TECH PROJECT REPORTS

1.1. Project reports should be typed neatly only on one side of the paper with 1.5 or double line spacing on a A4 size bond paper (210 x 297 mm). The margins should be: Left - 1.25", Right - 1", Top and Bottom - 0.75".

1.2. The total number of reports to be prepared are:

- One copy to the department
- One copy to the concerned guide(s)
- One copy to the candidate.

1.3. Before taking the final printout, the approval of the concerned guide(s) is mandatory and suggested corrections, if any, must be incorporated.

1.4. For making copies dry tone Xerox is suggested.

1.5. Every copy of the report must contain

- Inner title page (White)
- Outer title page with a plastic cover
- Certificate in the format enclosed both from the college and the organization where the project is carried out.
- An abstract (synopsis) not exceeding 100 words, indicating salient features of the work.

6.6. The organization of the report should be as follows:

1.	Inner title page	Usually numbered in roman
2.	Abstract or Synopsis	
3.	Acknowledgments	
4.	Table of Contents	
5.	List of table & figures (optional)	

6.7 Chapters (to be numbered) containing Introduction, which usually specifies the scope of work and its importance and relation to previous work and the present developments, Main body of the report divided appropriately into chapters, sections and subsections.

- The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc., and subsections as 2.2.3, 2.5.1 etc.
- The report should be typed in "MS-Word" file with "calibri" font. The chapter must be left or right justified (font size 16). Followed by the title of chapter centered (font size 18), section/subsection numbers along with their headings must be left justified with section number and its heading in font size 16 and subsection and its heading in font size 14. The body or the text of the report should have font size 11.
- The figures and tables must be numbered chapter wise for e.g.: Fig. 2.1 Block diagram of a serial binary adder, Table 3.1 Primitive flow table, etc.
- The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.

6.8. Reference OR Bibliography: The references should be **numbered serially** in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [3]. The section on references should list them in serial order in the following format.

1. For textbooks - A.V. Oppenheim and R.W. Schafer, Digital Signal Processing, Englewood, N.J., Prentice Hall, 3 Edition, 1975.
2. For papers - Devid, Insulation design to combat pollution problem, Proc of IEEE, PAS, Vol 71, Aug 1981, pp 1901-1907.

6.9. Only SI units are to be used in the report. Important equations must be numbered in decimal form for e.g. **V = IZ** ..... **(3.2)**

6.10. All equation numbers should be right justified.

6.11. The project report should be brief and include descriptions of work carried out by others only to the minimum extent necessary. Verbatim reproduction of material available elsewhere should be strictly avoided. Where short excerpts from published work are desired to be included, they should be within quotation marks appropriately referenced.

6.12. Proper attention is to be paid not only to the technical contents but also to the organization of the report and clarity of the expression. Due care should be taken to avoid spelling and typing errors. The student should note that report-write-up forms the important component in the overall evaluation of the project

6.13. Hardware projects must include: the component layout, complete circuit with the component list containing the name of the component, numbers used, etc. and the main component data sheets as Appendix. At the time of report submissions, the students must hand over a copy of these details to the project coordinator and see that they are entered in proper registers maintained in the department.

6.14. Software projects must include a virus free disc, containing the software developed by them along with the read me file. Read me file should contain the details of the variables used, salient features of the software and procedure of using them: compiling procedure, details of the computer hardware/software requirements to run the same, etc. If the developed software uses any public domain software downloaded from some site, then the address of the site along with the module name etc. must be included on a separate sheet. It must be properly acknowledged in the acknowledgments.

6.15. Sponsored Projects must also satisfy the above requirements along with statement of accounts, bills for the same dully attested by the concerned guides to process further, They must also produce NOC from the concerned guide before taking the internal viva examination.

6.16. The reports submitted to the department/guide(s) must be hard bounded, with a plastic covering.

6.17. Separator sheets, used if any, between chapters, should be of thin paper

VARDHAMAN COLLEGE OF ENGINEERING

(Autonomous)

Shamshabad – 501 218, Hyderabad

Department of …….

CERTIFICATE

Certified that the project work entitled …….. carried out by Mr./Ms. ……..., Roll Number ……, a bonafide student of ……in partial fulfillment for the award of **Master of Technology** in …….…… of the Jawaharlal Nehru Technological University, Hyderabad during the year …….. It is certified that all corrections / suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

Name & Signature of the Guide **Name Signature of the HOD** **Signature of the Principal**

External Viva

Name of the examiners Signature with date

1.

2.

Certificate issued at the Organization where the project was carried out

(On a separate sheet, If applicable)

NAME OF THE INDUSTRY / ORGANIZATION, Address with pin code

CERTIFICATE

Certified that the project work entitled …….. carried out by Mr./Ms . ……., Roll Number……., a bonafide student of ……in partial fulfillment for the award of **Master of Technology** in …… of the Jawaharlal Nehru Technological University, Hyderabad during the year …….. It is certified that, he/she has completed the project satisfactorily

Name & Signature of the Guide **Name & Signature of the Head of Organization**

7. **DISTRIBUTION OF MARKS FOR M.TECH DISSERTATION EVALUATION**

S No.	Particulars	Max. Marks
1	Relevance of the subject in the present context	**10**
2	Literature Survey	**10**
3	Problem formulation	**10**
4	Experimental observation / theoretical modeling	**10**
5	Results – Presentation & Discussion	**20**
6	Conclusions and scope for future work	**10**
7	Overall presentation of the Thesis / Oral presentation	**20**
8	Project Report Writing	**10**
Total Marks		**100**

MALPRACTICES RULES
DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	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 University.
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 University 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 University 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 Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance	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

	of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge 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 officer-in-charge, 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 College campus 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.	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 University 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.	

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.

2. Shall VCE award its own Degrees?

No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name Vardhaman College of Engineering 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. Foreign Universities and Indian Industries will know our status through our college 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 continued past efforts on academic performances, 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 is a Non – Statutory body, which will keep a watch on the academics and keep its reports and recommendations every year. In addition to Academic Council, the highest academic body also supervises the academic matters. At the end of three years, there is an external inspection by the University for this purpose. 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 VCE as an Autonomous College qualify for University Medals and Prizes for academic excellence?

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

8. Can VCE have its own Convocation?

No, since the University awards the Degree the Convocation will be that of the University.

9. Can VCE give a provisional degree certificate?

Since the examinations are conducted by VCE and the results are also declared by VCE, the college sends a list of successful candidates with their final percentage of marks 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, besides the

autonomous status is more responsive to the needs of the industry. As a result, 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 25 % for internal assessment and 75 % for external assessment. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12. Will there be any Revaluation or Re-Examination System?
No. There will not be any Revaluation system or Re-examination. But, there is a personal verification of the answer scripts.

13. How fast Syllabi can be and should be changed?
Autonomy allows us the freedom to change the syllabi as often as we need.

14. Will the Degree be awarded on the basis of only final year performance?
No. The percentage of marks will reflect the average performance of all the semesters put together.

15. Who takes Decisions on Academic matters?
The Academic Council of College is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like the BOS which are like Boards of Studies of the University.

16. What is the role of Examination committee?
The Exam Committee is responsible for the smooth conduct of inter and external examinations. All matters involving the conduct of examinations, spot valuations, tabulations, preparation of Memorandum of Marks etc fall within the duties of the Examination Committee.

17. Is there any mechanism for Grievance Redressal?
Yes, the college has grievance redressal committee, headed by a senior faculty member of the college.

18. How many attempts are permitted for obtaining a Degree?
All such matters are defined in Rules & Regulations.

19. Who declares the result?
The result declaration process is also defined. After tabulation work 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 College Academic Council for its approval. The result is then declared on the college notice boards as well put on the web site of the college. It is eventually sent to the University.

20. What is our relationship with the Jawaharlal Nehru Technological University, Hyderabad?
We remain an affiliated college of the Jawaharlal Nehru Technological University, Hyderabad. The University has the right to nominate its members on the academic bodies of the college.

21. 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.

22. Shall we get autonomy for PG and Doctoral Programmes also?
Yes, presently our PG programmes are also enjoying autonomous status.

23. How many exams will be there as an autonomous college?
This is defined in the Rules & Regulations.