

VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

Affiliated to JNTUH, Approved by AICTE, Accredited by NAAC and ISO 9001:2015 Certified

Shamshabad - 501 218, Hyderabad, Telangana State, India.

www.vardhaman.org

MASTER OF TECHNOLOGY

ENGINEERING DESIGN

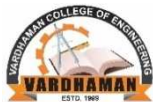
ACADEMIC REGULATIONS

COURSE STRUCTURE (VCE-R18)

CHOICE BASED CREDIT SYSTEM

(For batches admitted from the Academic Year 2018 - 2019)

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.



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PRELIMINARY DEFINITIONS AND NOMENCLATURES

- ❖ “Autonomous Institution / College” means an institution / college designated as autonomous institute / college by University Grants Commission (UGC), as per the UGC Autonomous College Statutes.
- ❖ “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” means Jawaharlal Nehru Technological University Hyderabad.
- ❖ “College” means Vardhaman College of Engineering, Hyderabad unless indicated otherwise by the context.
- ❖ “Program” means:
 - Master of Technology (M. Tech.) Degree program
 - PG Degree Program: M. Tech
- ❖ “Branch” means specialization in a program like M. Tech. program in Structural Engineering, M. Tech. program in Computer Science and Engineering etc.
- ❖ “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, B4911 English for Research Papers Writing, means a theory or practical subject, identified by its course-number and course-title, which is normally studied in a semester. The description of allocation of course code is mentioned in the table 1.

Table 1: Course Code Description

First Digit	Second Digit	Third Digit	Fourth and Fifth Digit
Indicates Program	Indicates Regulation	Indicates Department	Indicates Course Number
A : B. Tech. B : M. Tech. C : MBA	1 : R11 2 : R14 3 : R15 4 : R18	1 : WMC 2 : CSE 3 : PEED 4 : DECS 5 : SE 6 : ES 7 : ED 8 : Structural Engg. 9 : Other	01 02

- ❖ T – Tutorial, P – Practical, D – Drawing, L - Theory, C - Credits

FOREWORD

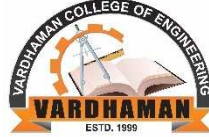
The autonomy conferred on Vardhaman College of Engineering by UGC based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the norms set by the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC 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 Board of Studies are constituted under the guidance of the Governing Body of the College and recommendations of the JNTUH to frame the regulations, course structure and syllabi under autonomous status.

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

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications, if 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



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Institute Vision:

- ❖ To be a pioneer institute and leader in engineering education to address societal needs through education and practice.

Institute Mission:

- ❖ To adopt innovative student centric learning methods.
- ❖ To enhance professional and entrepreneurial skills through industry institute interaction.
- ❖ To train the students to meet dynamic needs of the society.
- ❖ To promote research and continuing education.

Quality Policy:

- ❖ We at Vardhaman College of Engineering, endeavour to uphold excellence in all spheres by adopting best practices in effort and effect.

Department Vision:

- ❖ To be a premier center for producing competent mechanical engineers to cater the ever changing industrial demands and societal needs.

Department Mission:

- ❖ To impart knowledge and skills in basic and applied areas of Mechanical Engineering through innovative learner-centric approach.
- ❖ To associate with industries and research organizations for gaining real time practical knowledge.
- ❖ To facilitate continuous learning based on dynamic needs of the society.



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ACADEMIC REGULATIONS

M.Tech. Regular Two Year Post-Graduate Programme (For the batches admitted from the Academic Year 2018–2019)

For pursuing two year PG program of study in Master of Technology (M.Tech.) offered by Vardhaman College of Engineering and herein after Vardhaman College of Engineering is 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 2018-2019 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	Offering Department	Intake
1	Computer Science and Engineering	CSE	18
2	Digital Electronics and Communication Systems	ECE	18
3	Embedded Systems	ECE	18
4	Power Electronics and Electrical Drives	EEE	18
5	Engineering Design	ME	18
6	Structural Engineering	CE	18

4. ADMISSION

Admission into first year of two Year M.Tech degree program of study:

4.1.1. Eligibility

Admission to the M.Tech degree program shall be made subject to the eligibility, qualifications and specialization prescribed by Telangana State Council of Higher Education TSCHE, Government of Telangana.

Admissions shall be made based on the rank secured in PGECET examination conducted by Telangana State Council for Higher Education (or) GATE examination for allotment of a seat by the Convener, PGECET subject to reservations prescribed by the University or policies formed by the Government of Telangana from time to time.

4.2. Admission Procedure:

Admissions are made into the first year of two year M.Tech program as per the stipulations of Telangana State Council of Higher Education (TSCHE), Government of Telangana.

(a) Category - A seats are filled by the Convener, PGECET.

(b) Category - B seats are filled by the Management.

5. MEDIUM OF INSTRUCTION

The medium of instruction and examination is English for all the courses.

6. DURATION OF THE PROGRAMS

6.1 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.

6.2 Maximum Duration

6.2.1 The maximum period within which a student must complete a full-time academic program (Course Work i.e clearing all theory subjects) 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.

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

7. 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 21 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 including Examinations. The academic calendar is shown in Table 2 is declared at the start of the semester. The duration for each semester shall be a minimum of 16 weeks of instruction.

Table 2: Academic Calendar

I Year I Semester (21 weeks)	Instruction Period :16 weeks	18 weeks
	Mid Semester Tests :2 weeks	
	Preparation & Practical Examinations	1 week
	External Examinations	2 weeks
Semester Break		2 weeks
I Year II Semester (21 weeks)	Instruction Period :16 weeks	18 weeks
	Mid Semester Tests :2 weeks	
	Preparation & Practical Examinations	1 week
	External Examinations	2 weeks
Summer Vacation		4 weeks
II Year I Semester (20 Weeks)	Instruction Period and Project Phase- I	18 weeks
	Mid semester tests	
	Preparation and External Examinations	2 weeks
	Semester Break	2 weeks
II Year II Semester (18 weeks)	Project Work Phase – II	18 weeks

8. CHOICE BASED CREDIT SYSTEM

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

- 8.1 The duration of each semester will normally be 21 weeks with 6 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 four period hours of practical
- 2 credits for mini project with seminar
- 10 credits for project work phase – I
- 16 credits for project work phase – II

8.2 The two year curriculum of any M.Tech Specialization of study shall have total of 68 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.

9. COURSE REGISTRATION

- 9.1. A 'faculty advisor or counsellor' shall be assigned to a group of 5 students, who will advise student about the Post graduate program, its course structure and curriculum, choice/option for subjects/courses, based on their competence, progress, pre-requisites and interest.
- 9.2. The college Exam cell invites 'registration forms' from students before the beginning of the semester through 'on-line registration', ensuring 'date and time stamping'. The on-line registration requests for any 'current semester' shall be completed before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'.
- 9.3. A student can apply for on-line registration, only after obtaining the 'written approval' from faculty advisor/counsellor, which should be submitted to the Examination section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor/counsellor and the student.
- 9.4. If the student submits ambiguous choices or multiple options or erroneous entries during on-line registration for the subject(s)/course(s) under a given/specified course group/category as listed in the course structure, only the first mentioned subject/ course in that category will be taken into consideration.
- 9.5. Subject/course options exercised through on-line registration are final and cannot be changed or interchanged; further, alternate choices also will not be considered. However, if the subject/course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the head of the department, with due notification and time-framed schedule, within the first week after the commencement of class-work for that semester.
- 9.6. Open electives: The students have to choose one open elective (OEC) during II year I semester from the list of open electives given. However, the student cannot opt for an open elective subject offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.
- 9.7. Program Electives: The students have to choose Program elective I & II (PEC) in I year I semester, Program electives III, IV in I year II semester and Program elective V in II year I from the list of program electives given.

10. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

The performance of a student in each semester shall be evaluated subject- wise (irrespective of credits assigned) for a maximum of 100 marks. The M.Tech. project work (major project) will be evaluated for 200 marks. (100 marks for Phase – I and 100 marks for Phase – II)

- 10.1. For the theory subjects 70 marks shall be awarded for the performance in the Semester End Examination (SEE) and 30 marks shall be awarded for Continuous Internal Evaluation (CIE). The Final marks of Continuous Internal Evaluation is calculated based on 75% of best Marks and 25% of least marks secured in the two Mid-Term Examinations conducted. First Mid-Term examinations will be conducted in the middle of the Semester and second Mid-Term examinations during the last week of instruction. Each Mid-Term Examination shall be conducted for a total duration of 90 minutes. The question paper consist of 5 questions out of which 3 questions are to be answered, each question carrying 10 marks for a total of 30 marks. The details of the Question Paper pattern for Semester End Examination (Theory) are given below:

The Semester End Examination will be conducted for 70 marks. It consists of two parts.

- i. Part A for 20 marks,

ii. Part B for 50 marks.

Part A is compulsory and consists of 5 questions, one from each unit and carrying 4 marks each. Part B consists of 5 questions carrying 10 marks each. There will be two questions from each unit and only one should be answered.

The question paper shall be set externally and valued both internally and externally. If the difference between both the valuations is less than 15 marks, the average marks of the two valuations shall be awarded as final marks, otherwise third valuation will be conducted and the average marks of the best two valuations shall be awarded as final marks.

- 10.2.** For practical subjects, 70 marks shall be awarded for performance in the Semester End Examinations and 30 marks shall be awarded for day-to-day performance as Internal Marks.
- 10.3.** For conducting laboratory end examinations of all PG Programs, one internal examiner and one external examiner are to be appointed by the Principal of the College and this is to be informed to the Controller of Examinations within two weeks, before commencement of the lab end examinations. The external examiner should be selected from outside the College.
- 10.4.** Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.
- 10.5.** A Project Review Committee (PRC) shall be constituted with the Head of the Department as Chairperson, Project Supervisor and one senior faculty member of the Departments offering the M. Tech programme.
- 10.6.** A candidate has to present in Project Work Review I, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to the Project Work Review Committee (PRC) for approval within four weeks from the commencement of Second year First Semester. Only after obtaining the approval of the PRC the student can initiate the Project work.
- 10.7.** If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.
- 10.8.** A candidate shall submit his project progress report in two stages one in II year I semester and final one at the end of II year II Semester.
- 10.9.** The work on the project shall be initiated at the beginning of the II year I Semester and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of approval of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.
- 10.10.** The Project Work Review II in II Year I Sem. carries internal marks of 100. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate the work for the other 50 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Project Work. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review II (Phase –I) . If he fails to obtain the minimum required marks, he has to reappear for Project Work Review-II as and when conducted.
- 10.11.** The Project Work Review III in II Year II Sem.(Phase –II) carries 100 internal marks. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate it for the other 50 marks. The PRC will examine the overall progress of the Project Work and decide whether or not the Project is eligible for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review III. If he fails to obtain the required minimum marks, he has to reappear for Project Work Review III as and when conducted. For Project Evaluation (Viva Voce) in II Year II Sem. there are external marks of 100 and it is evaluated by the external examiner. The candidate has to secure a minimum of 50% marks in Project Evaluation (Viva-Voce) examination.
- 10.12.** After approval from the PRC, a soft copy of the thesis should be submitted for ANTIPLAGIARISM check and the plagiarism report should be submitted to the COE and to be included in the final thesis. The Thesis will be accepted for submission, if the similarity index is less than 30%. If the similarity index has more than the required percentage, the student is advised to modify accordingly and re-submit the soft copy of the thesis after one month. The maximum number of re-submissions of thesis

after plagiarism check is limited to THREE. After three attempts, the admission is liable to be cancelled. The departments HODs are advised to make plagiarism check of every soft copy of these before submissions.

- 10.13. Three copies of the Project Thesis certified by the supervisor shall be submitted to the department, after submission of a research paper related to the project work in any peer reviewed Journal or Scopus Indexed Conference. A copy of the submitted research paper shall be attached to thesis.
- 10.14. The thesis shall be adjudicated by an external examiner selected by the Principal. For this, the department HOD shall submit a panel of three examiners from among the list of experts in the relevant specialization as submitted by the supervisor concerned.
- 10.15. If the report of the external examiner is unsatisfactory, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unsatisfactory again, the thesis shall be summarily rejected. Subsequent actions for such dissertations may be considered, only on the specific recommendations of the external examiner and /or Project work Review Committee. No further correspondence in this matter will be entertained, if there is no specific recommendation for resubmission.
- 10.16. If the report of the examiner is satisfactory, the Head of the Department shall coordinate and make arrangements for the conduct of Project Viva- Voce examination. The Project Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis. The candidate has to secure a minimum of 50% of marks in Project Evaluation (Viva-Voce) examination.
- 10.17. If he fails to fulfill the requirements as specified above, he will reappear for the Viva-Voce examination only after three months. In the reappeared examination also, if he fails to fulfill the requirements, he will not be eligible for the award of the degree, unless he is asked to revise and resubmit his project work by the board within a specified time period . The Project Viva-Voce External examination marks must be submitted to the Exam cell on the day of the examination.
- 10.18. 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.
- 10.19. 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.
- 10.20. Audit course examination will be conducted at the end of the semester through open book system and evaluated internally.

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

- 11.1. 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.
- 11.2. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Council.
- 11.3. Shortage of attendance below 65% in aggregate shall in no case be condoned.
- 11.4. 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.
- 11.5. 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.
- 11.6. A stipulated fee shall be payable towards condonation of shortage of attendance to the College.
- 11.7. 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 Telangana norms in vogue.

12. 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 Mini Project with seminar, a student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each of them if he 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 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 **68** credits and earn all the **68** credits. Grades obtained in all the 68 credits shall be considered for the award of the class based on aggregate of grades (CGPA).
- v. 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.

13. 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, if it is scheduled.

14. REVALUATION

Students shall be permitted to apply for revaluation (Only for theory courses) after the declaration of semester end examination results within due dates by paying prescribed fee. After revaluation if there is any betterment in the grade then improved grade will be considered. Otherwise old grade shall be retained.

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 up to 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 fulfils 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

After a student has satisfied the requirement prescribed for the completion of the Program and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following four classes shown in Table 3:

Table 3: Declaration of Class based on CGPA (Cumulative Grade Point Average)

Class Awarded	Grades to be Secured	From the aggregate marks secured from 68 Credits
First Class with Distinction	≥ 7.75 CGPA	
First Class	=6.75 to <7.75 CGPA	
Pass Class	=6.0 to <6.75 CGPA	
Fail	Below 6.0 CGPA	

17.3. Letter Grade and Grade Point

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 Pass Class, as mentioned in Table 4.

Table 4: Percentage Equivalence of Grade Points (For a 10-Point Scale)

Grade	Grade Points (GP)	Percentage of Marks
O	10	≥ 90
A+	9	≥ 80 and <90
A	8	≥70 and < 80
B+	7	≥ 60 and <70
B	6	≥ 50 and <60
F	0	Below 50
AB	0	ABSENT

To calculate the final percentage of marks equivalent to the computed CGPA, the following formula may be used.

$$\text{Percentage of marks} = (\text{CGPA} - 0.5) \times 10$$

Semester Grade Point Average (SGPA)

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$\text{SGPA } (S_i) = \frac{\sum (C_i \times G_i)}{\sum C_i}$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by student in the i^{th} course.

Cumulative Grade Point Average (CGPA)

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$\text{CGPA} = \frac{\sum (C_i \times S_i)}{\sum C_j}$$

Where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester. C_j is the total number of credits of entire program.

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

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

21.2. 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 JNTUH 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.

27.3. 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.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	<i>If the student:</i>	
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 student 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 student orally or by any other body language methods or communicates through cell phones with any student 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 students 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 student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student 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 student is to be cancelled and sent to the University.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student, 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 student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student 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 student 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 student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student 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 of any kind in and around the examination hall or organizes a walk out or instigates others to walk out,	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the

	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.	remaining examinations of the subjects of that semester/year. The students 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 student 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 student is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the student 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 student 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 student is also debarred and forfeits the seat.
9.	If student of the college, who is not a student 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 student 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 student 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 student 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 student 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.	

COURSE STRUCTURE (VCE-R18)

M. TECH – ENGINEERING DESIGN

REGULATIONS: VCE–R18

I YEAR I SEMESTER							
Code	Subject	Periods per Week		Credits	Scheme of Examination Maximum Marks		
		L	P		Internal	External	Total
B4701	Advanced Mechanics of Solids	3	0	3	30	70	100
B4702	Analysis and synthesis of Mechanisms	3	0	3	30	70	100
PROGRAM ELECTIVE – I		3	0	3	30	70	100
PROGRAM ELECTIVE – II		3	0	3	30	70	100
B4703	Advanced Computer Aided Modeling Lab	0	4	2	30	70	100
B4704	Kinematics and Dynamics Lab	0	4	2	30	70	100
B4905	Research Methodology and IPR	2	0	2	30	70	100
	Audit Course-I	2	0	0	100*	0	100*
TOTAL		16	08	18	210	490	700
I YEAR II SEMESTER							
Code	Subject	Periods per week		Credits	Scheme of Examination Maximum Marks		
		L	P		Internal	External	Total
B4705	Finite Element Analysis	3	0	3	30	70	100
B4706	Computer Aided Design	3	0	3	30	70	100
PROGRAM ELECTIVE - III		3	0	3	30	70	100
PROGRAM ELECTIVE - IV		3	0	3	30	70	100
B4707	Numerical Methods and Analysis Lab	0	4	2	30	70	100
B4708	Advanced Design Lab	0	4	2	30	70	100
B4709	Mini Project with Seminar	0	4	2	100	0	100
	Audit Course-II	2	0	0	100*	0	100*
TOTAL		14	12	18	280	420	700
II YEAR I SEMESTER							
Code	Subject	Periods per week		Credits	Scheme of Examination Maximum Marks		
		L	P		Internal	External	Total
PROGRAM ELECTIVE -V		3	0	3	30	70	100
OPEN ELECTIVE		3	0	3	30	70	100
B4710	Major Project Phase –I	0	20	10	100	0	100
TOTAL		6	20	16	160	140	300
II YEAR II SEMESTER							
Code	Subject	Periods per week		Credits	Scheme of Examination Maximum Marks		
		L	P		Internal	External	Total
B4711	Major Project Phase –II	0	32	16	30	70	100
TOTAL		0	32	16	30	70	100

* Grade Points awarded for audit courses will not be considered for calculating SGPA and CGPA.

M. TECH – ENGINEERING DESIGN

REGULATIONS: VCE–R18

PROGRAM ELECTIVES			
PROGRAMME ELECTIVE – I		PROGRAMME ELECTIVE - II	
Code	Subject	Code	Subject
B4751	Numerical Methods in Engineering	B4754	Advanced Engineering Materials
B4752	Robotics	B4755	Tribology
B4753	Mechanics of Composite Materials	B4756	Fracture, Fatigue and Creep
PROGRAMME ELECTIVE - III		PROGRAMME ELECTIVE - IV	
Code	Subject	Code	Subject
B4757	Advanced Machine Design	B4760	Mechanical Vibrations
B4758	Advanced Stress Analysis	B4761	Condition Based Monitoring
B4759	Multi Body Dynamics	B4762	Optimization Techniques in Design
PROGRAMME ELECTIVE - V			
B4763	Advanced Finite Element Method		
B4764	Advances in Metallurgy		
B4765	Design for Manufacturing		
OPEN ELECTIVES		AUDIT COURSE-I & II	
B4901	Business Analytics	B4911	English for Research Papers Writing
B4902	Industrial safety	B4912	Disaster Management
B4903	Operations Research	B4913	Sanskrit for Technical Knowledge
B4904	Waste to Energy	B4914	Value Education
		B4915	Constitution of India
		B4916	Pedagogy Studies
		B4917	Stress Management by Yoga
		B4918	Personality Development through Life Enlightenment skills.

**SYLLABI FOR
I YEAR I SEMESTER**

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. TECH. ED I YEAR I SEM.

VCE-R18

ADVANCED MECHANICS OF SOLIDS

COURSE CODE: B4701

L	P	C
3	0	3

SYLLABUS

UNIT - I

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

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

UNIT – II

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.

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

UNIT - III

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 - IV

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.

UNIT – V

THEORY OF ELASTICITY: Analysis of stress, analysis of strain, Elasticity Problems in two dimensions and three dimensions, Mohr's circle for three dimensional stresses. Stress tensor, Airy's stress function in rectangular and polar coordinate.

TEXT BOOKS:

1. Arthur P. Boresi, Richard J. Schmidt (2009), *Advanced Mechanics Of Materials, 6 th 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.*

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. TECH. ED I YEAR I SEM.

VCE-R18

ANALYSIS AND SYNTHESIS OF MECHANISMS

COURSE CODE: B4702

L	P	C
3	0	3

SYLLABUS

UNIT – I

BASIC CONCEPTS: Definitions and assumptions; planar and spatial mechanisms; Mobility Criterion for Planar Mechanisms, kinematic pairs; degree of freedom; equivalent mechanisms; Kinematic Analysis of Planar Mechanisms. Review of graphical and analytical methods of velocity and acceleration analysis of kinematically simple mechanisms.

UNIT – II

CURVATURE THEORY: Fixed and moving centrodes, inflection circle, Euler-Savary equation, Bobillier constructions, cubic of stationary curvature, Applications in dwell mechanisms.

UNIT – III

KINEMATIC SYNTHESIS of planar mechanisms, accuracy (precision) points, Chebesychev spacing, types of errors, Graphical synthesis for function generation and rigid body guidance with two, three and four accuracy points using pole method, Analytical synthesis of four-bar and slider-crank mechanisms.

UNIT – IV

Freudenstein's equation, synthesis for four and five accuracy points, synthesis of four-bar for prescribed angular velocities and accelerations using complex numbers, three accuracy point synthesis using complex numbers.

UNIT – V

COUPLER CURVES: Equation of coupler curve, Robert-Chebychev theorem, double points and symmetry. Kinematic Analysis of Spatial Mechanisms, Denavit-Hartenberg parameters, matrix method of analysis of spatial mechanisms

TEXT BOOKS:

1. R.S. Hartenberg and J. Denavit, "Kinematic Synthesis of Linkages", McGraw-Hill, New York, 1980.
2. Robert L. Norton, "Design of Machinery", Tata McGraw Hill Edition.

REFERENCE BOOKS:

1. Hamilton H. Mabie, "Mechanisms and Dynamics of Machinery", John Wiley and sons New York.
2. S.B. Tuttle, "Mechanisms for Engineering Design" John Wiley and sons New York.
3. Ghosh and A.K. Mallik, "Theory of Machines and Mechanisms", Affiliated East-West Press, New Delhi, 1988.
4. A.G. Erdman and G.N. Sandor, "Mechanism Design - Analysis and Synthesis", (Vol. 1 and 2), Prentice Hall India, 1988.
5. A.S. Hall, "Kinematics and Linkage Design", Prentice Hall of India.
6. J.E. Shigley and J.J. Uicker, "Theory of Machines and Mechanisms", 2nd Edition, McGraw-Hill, 1995.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. TECH. ED I YEAR I SEM.

VCE-R18

NUMERICAL METHODS IN ENGINEERING

(Programme Elective – I)

COURSE CODE: B4751

L	P	C
3	0	3

SYLLABUS

UNIT - I

NUMERICAL METHODS IN LINEAR ALGEBRA: Direct and iterative solution techniques for simultaneous linear algebraic equations – Gauss elimination, Gauss-Jordon, LU Decomposition, QR Method, Jacobi and Gauss-Seidel Methods

UNIT - II

EIGENVALUES AND EIGENVECTORS – Power and inverse power method, householder transformation, physical interpretation of eigen values and eigenvectors, Eigen value problems in engineering.

UNIT – III

SOLUTION OF NONLINEAR ALGEBRAIC EQUATIONS: Bisection method, fixed-point iteration method, Newton-Raphson, Secant method, solution of system of nonlinear algebraic equations. Interpolation: Polynomial interpolation, Lagrange interpolating polynomial, Hermite interpolation, interpolation in 2 and 3 dimensions

UNIT – IV

NUMERICAL DIFFERENTIATION AND INTEGRATION Finite difference formula using Taylor series, Differentiation of Lagrange polynomials, Simpson’s rule, Gauss-quadrature rule, Romberg method, multiple integrals

UNIT – V

NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS Ordinary Differential Equations – Euler, Heun’s method and Stability criterion, second order and fourth order Runge-Kutta methods, Adams-Bashforth-Moulton method, system of ODEs and nonlinear ODEs

TEXT BOOKS:

1. S. P. Venkateshan, Prasanna Swaminathan, *Computational Methods in Engineering*, Ane Books.
2. Steven C. Chapra, *Numerical Methods for Engineering*, Mc-Graw Hill Education.

REFERENCE BOOKS:

1. Joe D Hoffman, *Numerical Methods for Engineers and Scientists*, Second Edition, Marcel Dekker (2001).
2. Gilbert Strang, *Computational Science and Engineering*, Wellesley-Cambridge Press.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. TECH. ED I YEAR I SEM.

VCE-R18

ROBOTICS
(PROGRAM ELECTIVE – I)

COURSE CODE: B4752

L	P	C
3	0	3

SYLLABUS

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 transformation, Representation of links using D-H parameters, Transformation matrices, Transformation matrices for 2R, 3R manipulators and planar four bar mechanisms.

KINEMATICS OF MANIPULATORS: Degrees of freedom of a manipulator, Loop constraint equations. Direct kinematics of 2R and 3R manipulator, Planar four bar mechanism. Inverse kinematics of 2R and 3R manipulator, Inverse kinematics of planar four bar mechanisms.

UNIT – II

VELOCITY AND STATICS OF MANIPULATORS: Introduction, Linear and angular velocity of links, Jacobian matrix, Singularities in Velocity domain, Statics equilibrium, Force and Torque analysis, Singularity in force domain.

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

UNIT – III

TRAJECTORY PLANNING: Joint space schemes, Cubic trajectory, Joint space schemes with via points, Cubic trajectory with a via point, Third order polynomial trajectory planning, Cartesian space schemes, Cartesian straight line and circular motion planning.

CONTROL: Feedback control of a single link manipulator, First order and Second order systems, PID control, PD control of multi link manipulator, Cartesian control of manipulators, Force control of manipulators-Force control of single mass.

UNIT – IV

ACTUATORS: Types, Characteristics of actuating system, Hydraulic and Pneumatic actuators, Electric Motors: DC motors, Reversible AC motors, Brushless DC motors, Stepper motors- structure and principle of operation, Stepper motor speed-torque characteristics.

UNIT – V

SENSORS: Sensor desirable features, Position sensors, Velocity sensor, Acceleration sensors, Force and Pressure sensors, Torque sensors, Touch and tactile sensor, Proximity sensors and Range sensors.

ROBOT GRIPPERS: Types of Grippers, Design aspect for gripper, Force analysis for various basic gripper systems.

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.*
3. *M. P. Groover (2010), Industrial Robotics, 3rd edition, Pearson Education, New Delhi.*

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

MECHANICS OF COMPOSITE MATERIALS
(Program Elective – I)

Course Code: B4753

L	P	C
3	0	3

SYLLABUS

UNIT – I

INTRODUCTION: Definition and characteristics, Overview of advantage and limitations of composite materials, Significance and objectives of composite materials, Science and technology, current status and future prospectus.

UNIT – II

BASIC CONCEPTS AND CHARACTERISTICS: Structural performance of conventional material, Geometric and physical definition, Material response, Classification of composite materials, Scale of analysis; Micromechanics, Basic lamina properties, Constituent materials and properties, Properties of typical composite materials

UNIT – III

ELASTIC BEHAVIOR OF UNIDIRECTIONAL LAMINA: Stress-strain relations, Relation between mathematical and engineering constants, transformation of stress, strain and elastic parameters.

UNIT – IV

STRENGTH OF UNIDIRECTIONAL LAMINA: Micromechanics of failure; failure mechanisms, Macro-mechanical strength parameters, Macro-mechanical failure theories, Applicability of various failure theories.

UNIT – V

ELASTIC BEHAVIOR OF LAMINATE: Basic assumptions, Strain-displacement relations, Stress-strain relation of layer within a laminate, Force and moment resultant, general load–deformation relations, Analysis of different types of laminates.

STRESS AND FAILURE ANALYSIS OF LAMINATES: Types of failures, Stress analysis and safety factors for first ply failure of symmetric laminates, Micromechanics of progressive failure; Progressive and ultimate laminate failure, Design methodology for structural composite materials.

TEXT BOOKS:

1. Isaac M. Daniels, Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press, 1994.
2. Bhagwan D. Agarwal, Lawrence J. Broutman, "Analysis and Performance of fiber composites", John Wiley and Sons, Inc. 1990.

REFERENCE BOOKS:

1. Mathews, F. L. and Rawlings, R. D., "Composite Materials: Engineering and Science", CRC Press, Boca Raton, 03.
2. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and Structures", University Press, 04.
3. Mazumdar S. K., "Composite Manufacturing – Materials, Product and Processing Engineering", CRC Press, Boca Raton, 02.
4. Robert M. Jones, "Mechanics of Composite Materials", Taylor and Francis, Inc., 1999.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

ADVANCED ENGINEERING MATERIALS
(Program Elective – II)

Course Code: B4754

L	P	C
3	0	3

SYLLABUS

UNIT – I

INTRODUCTION, ATOMIC STRUCTURE, INTER-ATOMIC BONDING AND STRUCTURE OF CRYSTALLINE SOLIDS: Historical perspective of Materials Science. Why study properties of materials. Classification of materials. Advanced Materials, Future materials and modern materials, Atomic structure. Atomic bonding in solids, Crystal structures, Crystalline and non-crystalline materials. Miller indices. Anisotropic elasticity. Elastic behaviour of composites. Structure and properties of polymers. Structure and properties of ceramics.

UNIT –II

IMPERFECTIONS IN SOLIDS AND MECHANICAL PROPERTIES OF METALS, DIFFUSION, DISLOCATIONS AND STRENGTHENING MECHANISMS: Point defects. Theoretical yield point. Line defects and dislocations. Interfacial defects. Bulk or volume defects. Atomic vibrations; Elastic deformation. Plastic deformation. Interpretation of tensile stress-strain curves Yielding under multiaxial stress. Yield criteria and macroscopic aspects of plastic deformation. Property variability and design factors, Diffusion mechanisms. Steady and non-steady state diffusion. Factors that influence diffusion. Non-equilibrium transformation and microstructure, Dislocation and plastic deformation. Mechanisms of strengthening in metals. Recovery, recrystallization and grain growth. Strengthening by second phase particles. Optimum distribution of particles. Lattice resistance to dislocation motion.

UNIT –III

PHASE DIAGRAMS: Equilibrium phase diagrams. Particle strengthening by precipitation. Precipitation reactions. Kinetics of nucleation and growth. The iron-carbon system. Phase transformations. Transformation rate effects and TTT diagrams. Microstructure and property changes in iron-carbon system.

FAILURE: Fracture. Ductile and brittle fracture. Fracture mechanics. Impact fracture. Ductile brittle transition. Fatigue. Crack initiation and propagation. Crack propagation rate. Creep. Generalized creep behaviour. Stress and temperature effects.

UNIT –IV

APPLICATIONS AND PROCESSING OF METALS AND ALLOYS, POLYMERS, CERAMICS, AND COMPOSITES: Types of metals and alloys. Fabrication of metals. Thermal processing of metals. Heat treatment. Precipitation hardening. Types and applications of ceramics. Fabrication and processing of ceramics, Mechanical behaviour of polymers. Mechanisms of deformation and strengthening of polymers. Crystallization, melting and glass transition. Polymer types. Polymer synthesis and processing, Particle reinforced composites. Fibre reinforced composites. Structural composites.

UNIT –V

ELECTRICAL, THERMAL, OPTICAL AND MAGNETIC PROPERTIES AND ECONOMIC CONSIDERATIONS:

Electrical conduction. Semi conductivity. Super conductivity. Electrical conduction in ionic ceramics and in polymers. Dielectric behaviour. Ferro electricity. Piezoelectricity.

Heat capacity. Thermal expansion. Thermal conductivity. Thermal stresses Diamagnetism and Para magnetism. Ferromagnetism. Ant-ferromagnetism and ferromagnetism. Influence of temperature on magnetic behaviour. Domains and Hysteresis, Basic concepts. Optical properties of metals. Optical properties of non-metals. Application of optical phenomena.

Economic, Environmental and Social Issues of Material Usage- Economic considerations. Environmental and societal considerations. Recycling issues. Life cycle analysis and its use in design.

TEXT BOOKS:

1. *Materials Science and Engineering, William D. Callister, Jr, John Wiley & sons, 07.*
2. *Modern Physical Metallurgy and Material Engineering, Science, Process, application, Smallman R.E., Bishop R J, Butterworth Heinemann, Sixth Ed., 1999.*

REFERENCE BOOKS:

1. *Materials Science and Engineering, V. Raghavan, PHI, 2004.*
2. *An Introduction to Materials Science and Engineering, W. D. Callister, John Wiley & Sons (2007).*

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

TRIBOLOGY
(Program Elective – II)

Course Code: B4755

L	P	C
3	0	3

SYLLABUS

UNIT –I

Friction, theories of friction, Friction control, Surface texture and measurement, genesis of friction, instabilities and stick-slip motion.

UNIT –II

Wear, types of wear, theories of wear, wear prevention. Tribological properties of bearing materials and lubricants.

UNIT –III

Lubrication, Reynolds's equation and its limitations, idealized bearings, infinitely long plane pivoted and fixed show sliders, infinitely long and infinitely short (narrow) journal bearings, lightly loaded infinitely long journal bearing (Petroff's solution), Finite Bearings, Design of hydrodynamic journal bearings

UNIT – IV

Hydrostatic, squeeze film Circular and rectangular flat plates, variable and alternating loads, piston pin lubrications, application to journal bearings.

UNIT –V

Elasto-hydrodynamic lubrication – pressure viscosity term in Reynolds's equation, Hertz' theory, Ertel-Grubin equation, lubrication of spheres, gear teeth and rolling element bearings, Air lubricated bearings, Tilting pad bearings.

TEXT BOOKS:

1. Cameron, "Basic Lubrication Theory", Ellis Horwood Ltd, 1981.
2. Principles in Tribology, Edited by J. Halling, 1975

REFERENCE BOOKS:

1. Fundamentals of Fluid Film Lubrication – B. J. Hamrock, McGraw Hill International, 1994
2. D.D. Fuller, "Theory and Practice of Lubrication for Engineers", John Wiley and Sons, 1984.
3. "Fundamentals of Friction and wear of Materials" American Society of Metals.
4. Introduction to Tribology of Bearings –B. C. Majumdar, A. H. Wheeler &co. pvt. ltd 1985.
5. T.A. Stolarski, "Tribology in Machine Design".

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

FRACTURE, FATIGUE AND CREEP
(Program Elective – II)

Course Code: B4756

L	P	C
3	0	3

SYLLABUS

UNIT - I

INTRODUCTION: Types of fracture, cohesive strength, Elliptical crack model, Modes of fracture, Dislocation theory for brittle fracture, Prediction of mechanical failure, Macroscopic failure modes; brittle and ductile behavior, Fracture in brittle and ductile materials – characteristics of fracture surfaces; intergranular and intragranular 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.

Griffith's analysis, Concept of energy release rate (G), fracture energy, crack resistance(R), Modification for ductile materials, loading conditions. Critical energy release rate.

UNIT - II

LINEAR ELASTIC FRACTURE MECHANICS (LEFM) : 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.

Crack tip plasticity, The Irwin approach, Shape and size of plastic zone, definition of plane stress and Plane strain and the effect of component thickness, Crack tip triaxiality.

UNIT – III

ELASTIC-PLASTIC FRACTURE MECHANICS (EPFM): The definition of alternative failure prediction parameters, Crack Tip Opening Displacement (CTOD), The J integral, J as path-independent line integral and stress intensity parameter, Relation between J and CTOD.

The effect of Microstructure on fracture mechanism and path, crack growth resistance curve, cleavage and ductile failure, factors improving toughness.

UNIT-IV

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. Goodman's rule and Miners rule. Micro mechanisms of fatigue damage, Fatigue crack propagation, leading to a consideration of factors enhancing fatigue resistance, Strain life equation, effect of stress concentration on fatigue, Fatigue under combined stress Total life and damage tolerant approaches to life prediction, Damage tolerance methodology.

UNIT - V

CREEP DEFORMATION: The evolution of creep damage, the creep curve, Structural changes during creep, Mechanism of creep deformation, Activation energy for steady state creep, Fracture at elevated temperature, Prediction of long time properties (Larson-Miller parameters), Damage accumulation rule, Creep-fatigue interactions, Stress dependence of creep - power law dependence. Comparison of creep performance under different conditions.

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.
3. George E Dieter, *Mechanical Metallurgy*, McGraw-Hill Book Company.

REFERENCE BOOKS:

1. Brook D, "Elementary fracture mechanics".
2. M. Janssen, J. Zuidema, R. J. H. Wanhill (2004), *Fracture mechanics*, 2nd Edition, Spon Press, New York, USA.
3. J. F. Knott (1981), *Fundamentals of Fracture Mechanics*, Reprint Edition, Butterworths, London, UK.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

RESEARCH METHODOLOGY AND IPR

Course Code: B4905

L	P	C
2	2	2

SYLLABUS

UNIT – I

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

UNIT – II

Effective literature studies approaches, analysis Plagiarism, and Research ethics.

UNIT – III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT – IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, and development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc., Traditional knowledge Case Studies, IPR and IITs.

TEXT BOOKS:

1. *Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science& engineering students.*
2. *Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction.*

REFERENCE BOOKS:

1. *T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.*
2. *Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners.*

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

ENGLISH FOR RESEARCH PAPERS WRITING
(Audit Course– I)

Course Code: B4911

L	P	C
0	4	2

SYLLABUS

UNIT - I

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

UNIT - II

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

UNIT - III

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

UNIT - IV

Key skills are needed when writing a Title, key skills are needed when writing an abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT - V

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

TEXT BOOKS:

1. *Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books).*
2. *Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.*

REFERENCE BOOKS:

1. *Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .*
2. *Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.*

VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

DISASTER MANAGEMENT

(Audit Course– I)

Course Code: B4912

L	P	C
0	4	2

SYLLABUS

UNIT - I

INTRODUCTION DISASTER: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT - II

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

UNIT - III

DISASTER PRONE AREAS IN INDIA: Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT - IV

DISASTER PREPAREDNESS AND MANAGEMENT: Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data From Meteorological and other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT - V

DISASTER RISK: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

TEXT BOOKS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies ""New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.), " Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.

REFERENCE BOOKS:

1. Goel S. L. , *Disaster Administration And Management Text And Case Studies* ,Deep &Deep Publication Pvt. Ltd., New Delhi.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

SANSKRIT FOR TECHNICAL KNOWLEDGE
(Audit Course– I)

Course Code: B4913

L P C
0 4 2

SYLLABUS

UNIT - I

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

UNIT - II

Order Introduction of roots Technical information about Sanskrit Literature

UNIT - III

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

TEXT BOOKS:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi.
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.

REFERENCE BOOKS:

1. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

VALUE EDUCATION
(Audit Course– I)

Course Code: B4914

L P C
0 4 2

SYLLABUS

UNIT - I

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

UNIT - II

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

UNIT - III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance.

UNIT - IV

True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT - V

Character and Competence -Holy books vs Blind faith Self-management and Good health Science of reincarnation. Equality, Nonviolence, Humility, Role of Women All religions and same message. Mind your Mind, Self-control.

TEXT BOOKS:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

ADVANCED COMPUTER AIDED MODELING LAB

Course Code: B4703

L	P	C
0	4	2

List of Experiments:

1. Introduction and Installation of CAD/CAE Software's.
2. Introduction to Solid Modeling
3. Introduction to MATLAB Programming.
4. Working with advanced modeling tools (Sweep, Blend & Swept Blend).
5. Generating, editing and modifying drawings.
6. Generating solids using Boolean operations.
7. Creating an assembly, moving components, wire frame and surface geometry.
8. Generating detailed drawings and bill of material.
9. Generating of Ferguson's cubic surface patches, Bezier surface patches and coons patches.
10. Exercises on Analytic Curves (Lines, Circles, Ellipses, Parabolas, Hyperbolas, Conics) using MATLAB Programming.
11. Exercises on Synthetic Curves (Cubic Spines, Bezier Curves, B-Spline Curves) using MATLAB Programming.
12. Working with CAD Data Exchange formats: IGES, ACIS, DXF and STL.

SOFTWARE: CATIA V5/CREO/MATLAB

Note: Minimum 12 of the above experiments are to be conducted

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year I Sem.

VCE-R18

KINEMATICS AND DYNAMICS LAB

Course Code: B4704

L	P	C
0	4	2

List of Experiments:

1. Static balancing using steel balls.
2. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils.
3. Field balancing of the thin rotors using vibration pickups.
4. Determination of steady state amplitude of forced vibratory system.
5. To determine the active and reactive gyroscopic couples and compare them.
6. To determine the characteristic curves of the watt and porter governors.
7. To determine the characteristic curves of the Proel and spring loaded governor governors.
8. To determine the characteristics journal bearing.
9. To study frictional behavior of different combinations of Materials.
10. To study wear of different materials under various loads and sliding speed conditions.
11. Direct Kinematic analysis of a robot.
12. Inverse Kinematic analysis of a robot.
13. Trajectory planning of robot in joint space scheme.
14. Palletizing operation using Robot programming.

Note: Minimum 12 of the above experiments are to be conducted.

**SYLLABI FOR
I YEAR II SEMESTER**

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

FINITE ELEMENT ANALYSIS

Course Code: B4705

L	P	C
3	0	3

SYLLABUS

UNIT - I

Introduction, Classification of problems – Dimensionality, time dependence, Boundary Value problems, Initial value problems, Linear/Non-linear, etc.,

UNIT - II

Differential equation as the starting point for FEM, steps in finite element method, discretization, types of elements used, Shape functions, Linear Elements, Local and Global coordinates, Coordinate transformation and Gauss-Legendre scheme of numerical integration, Nodal degrees of freedom.

UNIT - III

Finite element formulation, variational, weighted residual and virtual work methods.

Unit - IV

1-D and 2-D problems from Structural Mechanics – Bar, Beam, Plane stress and plane strain problems, Axi-symmetric problems – Axi-symmetric forces and geometry.

UNIT – V

Computer implementation, higher order elements, Iso-parametric formulation.

Eigen-value problems, Natural vibration of bars and beams, Methods to find Eigen-values and Eigen-vectors.

TEXT BOOKS:

1. Chandrupatla and Belegundu "Introduction to Finite Elements in Engineering", Prentice Hall of India Pvt. Ltd. New Delhi, Ed.4, 11.
2. Logan Deryl L., "A First Course in Finite Element Method", Thomson Brook/Cole, 5th Ed. 12.

REFERENCE BOOKS:

1. Cook R.D. "Concepts and applications of finite element analysis" Wiley, New York, 4th Ed. 02.
2. Reddy J N, "Finite element Method", Tata McGraw Hill publishing Co Ltd, New Delhi, 3rd Ed., 05.
3. Bathe K.J., Cliffs, N.J. "Finite Element Procedures in Engineering Analysis", PHI Learning, Eastern Economy Editions, 09.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

COMPUTER AIDED DESIGN

Course Code: B4706

L	P	C
3	0	3

SYLLABUS

UNIT – I

CAD Hardware and Software, Types of systems and system considerations, input and output devices, hardware integration and networking, hardware trends, Software modules.

Computer Communications, Principle of networking, classification networks, networking, methods, transmission media and interfaces, network operating systems.

UNIT – II

Computer Graphics Introduction, transformation of geometric models: translation, scaling, reflection, rotation, homogeneous representation, concatenated transformations; mappings of geometric models, translational mapping rotational mapping, general mapping, mappings as changes of coordinate system; inverse transformations and mapping.

UNIT – III

Projections of geometric models, orthographic projections, Geometric Modeling, curve representation: Parametric representation of analytic curves, parametric representation of synthetic curves, curve manipulations. Surface representation.

UNIT – IV

Fundamentals of solid modeling, boundary representation (B-rep), Constructive Solid Geometry (CSG), sweep representation, Analytic Solid Modeling (ASM), other representations; solid manipulations, solid modeling based applications: mass properties calculations, mechanical tolerance etc.

UNIT – V

Finite Element Modeling and Analysis, Finite Element Analysis, finite element modeling, mesh generation mesh requirements, semiautomatic methods, fully automatic methods, design and engineering applications, System Simulation, Need of simulation, areas of applications, when simulation is appropriate tool / not appropriate, concept of a system, components of a system, discrete and continuous systems, model of a system, types of models, types of simulation approaches.

TEXT BOOKS:

1. Ibrahim Zeid, "CAD / CAM Theory and Practice".
2. Jim Browne, "Computer Aided Engineering and Design".

REFERENCE BOOKS:

1. P. Radhakrishnan / V. Raju / S. Subramanyam, "CAD / CAM / CIM".
2. P.N. Rao, "CAD / CAM principles and applications", Tata Mcraw-Hill, 02
3. Rogers / Adams, "Mathematical Elements for Computer Graphics".
4. Rooney and Steadman, "Principles of Computer Aided Design", Aug. 1993.
5. Jerry Banks / John Carson / Barry Nelson / David Nicol, "Discrete-Event System Simulation".

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

ADVANCED MACHINE DESIGN
(Program Elective – III)

Course Code: B4757

L	P	C
3	0	3

SYLLABUS

UNIT - I

Development processes and organizations, Product Planning.

UNIT - II

Need Identification and problem definition, product specification, concept generation and selection, evaluation, creativity methods, Concept testing.

UNIT – III

Design for manufacture, assembly, maintenance, casting, forging.

Design for Reliability, strength based reliability, parallel and series systems, robust design.

UNIT - IV

Industrial design: Design for Emotion and experience, Introduction to retrofit and Eco-design, Human behaviour in design.

UNIT - V

Rapid Prototyping: Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems. Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

TEXT BOOKS:

1. *George E Dieter, "Engineering Design", McGraw Hill Company.*
2. *G Boothroyd, P Dewhurst and W Knight, Product design for manufacture and assembly, John Wiley, NY: Marcel Dekkar, 1994.*

REFERENCE BOOKS:

1. *J G Bralla, Handbook for Product Design for Manufacture, McGraw Hill, NY, 1998.*
2. *C.K. Chua, K.F. Leong, C.S. Lim, "Rapid Prototyping: Principles And Applications", World Scientific Publishing Co Pte Ltd; 3rd Revised edition.*

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

ADVANCED STRESS ANALYSIS
(Program Elective – III)

Course Code: B4758

L	P	C
3	0	3

SYLLABUS

UNIT – I

THEORY OF ELASTICITY: Analysis of stress, Analysis of strain, Elasticity problems in two dimension and three dimensions, Mohr's circle for three dimensional stresses. Stress tensor, Airy's stress function in rectangular and polar coordinates.

UNIT – II

ENERGY METHODS: Energy method for analysis of stress, strain and deflection The three theorem's - theorem of virtual work, theorem of least work, Castiglione's theorem, Rayleigh Ritz method, Galerkin's method, Elastic behavior of anisotropic materials like fiber reinforced composites.

UNIT – III

THEORY OF TORSION: Torsion of prismatic bars of solid section and thin walled section. Analogies for torsion, membrane analogy, fluid flow analogy and electrical analogy. Torsion of conical shaft, bar of variable diameter, thin walled members of open cross section in which some sections are prevented from warping, Torsion of noncircular shaft.

UNIT – IV

UNSYMMETRICAL BENDING AND SHEAR CENTRE: Concept of shear center in symmetrical and unsymmetrical bending, stress and deflections in beams subjected to unsymmetrical bending, shear center for thin wall beam cross section, open section with one axis of symmetry, general open section, and closed section.

UNIT – V

PRESSURIZED CYLINDERS AND ROTATING DISKS: Governing equations, stress in thick walled cylinder under internal and external pressure, shrink fit compound cylinders, stresses in rotating flat solid disk, flat disk with central hole, disk with variable thickness, disk of uniform strength, Plastic action in thick walled cylinders and rotating disc.

TEXT BOOKS:

1. *Sadd, Martin H., Elasticity: Theory, applications and Numeric, Academic Press 05 (Text Book).*
2. *Boresi, A.P. and K. P. Chong, Elasticity in Engineering Mechanics, Second Edition, John Wiley & Sons.*

REFERENCE BOOKS:

1. *Budynas, R. G. Advance strength and Applied Stress Analysis, Second Edition, WCB/ McGraw Hill 1999.*
2. *Dally, J. W. and W.F. Riley, Experimental Stress Analysis, McGraw Hill International, Third Edition, 1991.*
3. *Theory of Elasticity – Timoshenko and Goodier, Mc Graw Hill.*
4. *Advanced Strength of Materials, Vol. 1,2 – Timoshenko, CBS.*
5. *Advanced Strength of Materials – Den Harteg.*

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

MULTI BODY DYNAMICS
(Program Elective – III)

Course Code: B4759

L	P	C
3	0	3

SYLLABUS

UNIT - I

INTRODUCTION: The method of constraints for planar kinematic analysis. Revolute, prismatic, gear and cam pairs are considered together with other 2 degrees – of - freedom types of constraints.

Basic principles for analysis of multi-body systems: The automatic assembly of the systems of equations for position, velocity and acceleration analysis. Iterative solution of systems of non linear equations. Geometry of masses. The principle of virtual work and Lagrange’s equations.

UNIT - II

DYNAMICS OF PLANAR SYSTEMS: Dynamics of planar systems. Systematic computation and assembly of mass matrix. Computation of planar generalized forces for external forces and for actuator – spring - damper element. Simple applications of inverse and forward dynamic analysis. Numerical integration of first-order initial value problems. The method of Baumgarte for the solution of mixed differential – algebraic equations of motion. The use of coordinates partitioning, QR and SVD decomposition for the orthogonalization of constraints.

UNIT - III

KINEMATICS OF RIGID BODIES IN SPACE: Reference frames for the location of a body in space. Euler angles and Euler parameters, The formula of Rodrigues, Screw motion in space. Velocity, acceleration and angular velocity. Relationship between the angular velocity vector and the time derivatives of Euler parameters.

UNIT – IV

KINEMATIC ANALYSIS OF SPATIAL SYSTEMS: Basic kinematic constraints. Joint definition frames. The constraints required for the description in space of common kinematic pairs (revolute, prismatic, cylindrical, spherical).Equations of motion of constrained spatial systems.

UNIT -V

COMPUTATION OF FORCES: Computation of spatial generalized forces for external forces and for actuator – spring – damper element. Computation of reaction forces from Lagrange’s multipliers.

TEXT BOOKS:

1. "Why Do Multi-Body System Simulation?" by Rajiv Rampalli, Gabriele Ferrarotti & Michael Hoffmann, Published NAFEMS Publications.
2. "Principles of Dynamics" by Donald T. Greenwood, 2nd ed., Prentice Hall.

REFERENCE BOOKS:

1. Wittenburg, J., Dynamics of Systems of Rigid Bodies, B.G. Teubner, Stuttgart, 1977.
2. Kane, T.R, Levinson, D.A., Dynamics: Theory and Applications, McGraw-Hill Book Co., 1985.
3. Nikravesh, P.E., Computer Aided Analysis of Mechanical Systems, Prentice-Hall Inc., Englewood Cliffs, NJ, 1988.
4. Roberson, R.E., Schwertassek, R., Dynamics of Multibody Systems, Springer-Verlag, Berlin, 1988.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

MECHANICAL VIBRTIONS

(Program Elective – IV)

Course Code: B4760

L	P	C
3	0	3

SYLLABUS

UNIT – I

INTRODUCTION: study of vibration, basic concepts of vibration, classification of vibration systems, simple harmonic motion, equivalent systems, mathematical modeling-inertia element, stiffness element, dissipation element, model construction.

UNIT - II

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.

TWO DEGREE OF FREEDOM SYSTEMS: Principal modes, Undamped and damped free and forced vibrations, coordinate coupling and principal coordinate, Undamped vibration absorbers.

UNIT - III

MULTI DEGREE OF 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.

UNIT – IV

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

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

UNIT - V

ROTOR UNBALANCED: Introduction, Torsional vibrations of single and multi – rotor systems, geared systems and critical speed without and with damping, secondary critical speed.

VIBRATION MEASUREMENT: Introduction, frequency response function measurement, force input, capacitive probe, laser vibrometers, velocity meters & accelerometers.

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. S S. Rao (2009), *Mechanical Vibrations, 4th Edition*, Pearson Publications.
2. Amy L. Galloway (2011), *Mechanical Vibrations: Types, Testing, and Analysis, 1st Edition*, Nova Science Publishers, New York, USA.
3. Stephen Timoshenko (2011), *Vibration problems in Engineering, 2nd Edition*, Oxford City Press, New York, USA.
4. Tony. L. Schmitz and K. Scott Smith, *Mechanical Vibrations: Modeling and Measurements*, Springer.
5. S Graham Kelly, *Mechanical Vibrations: Theory and Applications*, Cengage learning .

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

CONDITION BASED MONITORING
(Program Elective – IV)

Course Code: B4761

L	P	C
3	0	3

SYLLABUS

UNIT - I

The basic idea of health monitoring and condition monitoring of structures and machines. Some basic techniques.

UNIT - II

Basics of signal processing: Study of periodic and random signals, probability distribution, statistical properties, auto and cross correlation and power spectral density functions of commonly found systems, spectral analysis.

UNIT - III

Fourier transform: The basic ideas of Fourier transform interpretation and application to real signals. Response of linear systems to stationary random signals: FRFs, resonant frequencies, modes of vibration.

UNIT - IV

Introduction to vibration-based monitoring, Machinery condition monitoring by vibration analysis: Use and selection of measurements, analysis procedures and instruments.

UNIT - V

Typical applications of condition monitoring using vibration analysis to rotating machines. Some other health monitoring techniques, acoustic emission, oil debris and temperature analysis, Applications.

TEXT BOOKS:

1. M. Adams, *Rotating machinery analysis - from analysis to troubleshooting*, Marcel Dekker, New York, 01, ISBN 0-8247-0258-1.
2. Cornelius Scheffer Paresh Girdhar, *Practical Machinery Vibration Analysis and Predictive Maintenance*, Newnes, 1st Edition, 04, Paperback ISBN: 9780750662758.

REFERENCE BOOKS:

1. Isermann R., *Fault Diagnosis Applications*, Springer-Verlag, Berlin, 2011.
2. Rao, J S., *Vibration Condition Monitoring*, Narosa Publishing House, 2nd Edition, 2000.
3. Allan Davies, *Handbook of Condition Monitoring*, Chapman and Hall, 2000.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

OPTIMIZATION TECHNIQUES IN DESIGN
(Program Elective – IV)

Course Code: B4762

L	P	C
3	0	3

SYLLABUS

UNIT - I

Introduction to optimization, classification of optimisation problems, classical optimization techniques.

UNIT - II

Linear programming, simplex method and Duality in linear programming, sensitivity or post-optimality analysis, Karmarkar's methods.

UNIT – III

Non-Linear Programming:- One dimensional minimization, unconstrained and constrained minimization, direct and indirect methods.

UNIT - IV

Geometric programming, Optimum design of mechanical elements like beams, columns, gears, shafts, etc.,

UNIT - V

Introduction to Genetic Algorithms, Operators, applications to engineering optimization problems.

TEXT BOOKS:

1. S. S. Stricker, "Optimising performance of energy systems" Battelle Press, New York, 1985.
2. R.C. Johnson, "Optimum Design of Mechanical Elements", Willey, New York, 1980.

REFERENCE BOOKS:

1. J. S. Arora, "Introduction to Optimum Design", McGraw Hill, New York, 1989.
2. Kalyanmoy Deb, "Optimization for Engineering Design", Prentice Hall of India, New Delhi, 05
3. L.C.W. Dixon, "Non-Linear Optimisation - Theory and Algorithms", Birkhauser, Boston, 1980.
4. R.J. Duffin, E.L. Peterson and C.Zener "Geometric Programming-Theory and Applications", Willey, New York, 1967.
5. G.B. Dantzig "Linear Programming and Extensions Princeton University Press", Princeton, N. J., 1963.
6. R. Bellman "Dynamic Programming-Princeton" University Press, Princeton, N.J. 1957.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I YEAR I / II Sem.

VCE-R18

CONSTITUTION OF INDIA
(Audit Course)

Course Code: B4915

L	P	C
2	0	0

SYLLABUS

UNIT - I

HISTORY OF MAKING OF THE INDIAN CONSTITUTION: Drafting Committee, (Composition & Working).

UNIT - II

PHILOSOPHY OF THE INDIAN CONSTITUTION: Preamble, Salient Features

UNIT - III

CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy Fundamental Duties.

UNIT - IV

ORGANS OF GOVERNANCE: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT - V

LOCAL ADMINISTRATION: District's Administration head, Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayatiraj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

TEXT BOOKS:

1. *The Constitution of India, 1950 (Bare Act), Government Publication.*
2. *Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.*

REFERENCE BOOKS

1. *M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.*
2. *D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.*

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I YEAR I / II Sem.

VCE-R18

PEDAGOGY STUDIES
(Audit Course)

Course Code: B4916

L	P	C
2	0	0

SYLLABUS

UNIT - I

INTRODUCTION AND METHODOLOGY: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

UNIT - II

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

UNIT - III

EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES, METHODOLOGY FOR THE IN DEPTH STAGE: Quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT - IV

PROFESSIONAL DEVELOPMENT: Alignment with classroom practices and follow up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT - V

RESEARCH GAPS AND FUTURE DIRECTIONS: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

TEXT BOOKS:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, *Compare*, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, *Journal of Curriculum Studies*, 36 (3): 361-379.

REFERENCE BOOKS:

1. Akyeampong K (2003) *Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1*. London: DFID.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? *International Journal Educational Development*, 33 (3): 272-282.
3. Alexander RJ (2001) *Culture and pedagogy: International comparisons in primary education*. Oxford and Boston: Blackwell.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I YEAR I / II Sem.

VCE-R18

STRESS MANAGEMENT BY YOGA
(Audit Course)

Course Code: B4917

L	P	C
2	0	0

SYLLABUS

UNIT - I

Definitions of Eight parts of yoga. (Ashtanga)

UNIT - II

Yam and Niyam.

Do`s and Don`ts in life.

i) Ahimsa, satya, astheya, bramhacharya and aparigraha, ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT - III

Asan and Pranayam

i) Various yoga poses and their benefits for mind & body, ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS:

1. ‘Yogic Asanas for Group Tarining-Part-I’ :Janardan Swami Yogabhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.

VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

M. Tech. ED I YEAR I / II Sem.

VCE-R18

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

(Audit Course)

Course Code: B4918

L	P	C
2	0	0

SYLLABUS

UNIT - I

NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY: Verses- 19,20,21,22 (wisdom), Verses- 29, 31, 32 (pride & heroism),Verses- 26,28,63,65 (virtue), Verses- 52,53,59 (dont's),Verses- 71,73,75,78 (do's).

UNIT - II

APPROACH TO DAY TO DAY WORK AND DUTIES: Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47, 48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17,23, 35,Chapter 18-Verses 45, 46, 48.

UNIT - III

STATEMENTS OF BASIC KNOWLEDGE: Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18, Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36, 37, 42, Chapter 4-Verses 18, 38,39 , Chapter18 – Verses 37,38,63.

TEXT BOOKS:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

NUMERICAL METHODS AND ANALYSIS LAB

Course Code: B4707

L	P	C
0	4	2

LIST OF EXPERIMENTS:

1. Bisection method and Fixed-point iteration method
2. Newton-Raphson and Secant method
3. Numerical solution of ODE (Euler's Method)
4. Numerical solution of ODE (Runge-Kutta Method)
5. Stress analysis of a plate with a circular hole.
6. Stress analysis of rectangular L bracket
7. Stress analysis of an axi-symmetric component.
8. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
9. Mode frequency analysis of a 2 D component.
10. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
11. Harmonic analysis of a 2D component
12. Thermal stress analysis of a 2D component
13. Conductive heat transfer analysis of a 2D component
14. Convective heat transfer analysis of a 2D component

SOFTWARE: ANSYS/MATLAB

Note: Minimum 12 of the above experiments are to be conducted

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED I Year II Sem.

VCE-R18

ADVANCED DESIGN LAB

Course Code: B4708

L	P	C
0	4	2

LIST OF EXPERIMENTS:

1. Determination of natural frequency of given structure using FFT analyzer.
2. Diagnosis of a machine using FFT analyzer.
3. Advanced Spectrum Analysis.
4. Compressive/Tensile strength of 3D printed components Using different layer height
5. Compressive/Tensile strength of 3D printed components Using different infill
6. Buckling analysis of 3D printed components
7. Estimation of damping using logarithmic decrement curve
8. Determine the whirling speed of Shaft.
9. Transverse vibration of beam Apparatus
10. To determine the deflection of a structural member using Pin jointed setup.
11. Calculation of shear centre of different cross sections using Shear centre setup.
12. Buckling Analysis of column using column buckling setup.
13. To determine the deflection of a frame using Portal frame set up.
14. Analyze the stress distribution of structural member using curved beam apparatus

Note: Minimum 12 of the above experiments are to be conducted.

**SYLLABI FOR
II YEAR I SEMESTER**

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED II Year I Sem.

VCE-R18

ADVANCED FINITE ELEMENT METHODS
(Program Elective – V)

Course Code: B4763

L	P	C
3	0	3

UNIT – I

REVIEW OF LINEAR FEA

FE formulation of 1D bar, 3D linear elastic continuum, 2D plane strain, plane stress, and axisymmetric elements; Iso-parametric mapping; numerical integration.

UNIT – II

FE FORMULATION FOR 1D PLASTICITY

Elastic-perfectly plastic material; Isotropic and kinematic hardening; Integration algorithms for 1D plasticity; FE formulation; Newton-Raphson method for solving nonlinear equilibrium equations; 1D visco-plasticity and integration algorithm.

UNIT – III

CONTINUUM THEORIES OF PLASTICITY

Review of tensor algebra; Yield condition, flow rule and hardening rules; loading and unloading conditions; Drucker's stability postulates; Convexity and normality; J2 flow theory of plasticity and visco-plasticity, Gurson model.

UNIT – IV

FE PROCEDURES FOR 2D AND 3D PLASTICITY:

Integration algorithms for rate independent plasticity—explicit forward Euler and implicit backward Euler; Return mapping algorithm; visco-plasticity; FE formulation; Consistent linearization; Algorithmic and consistent tangent moduli, Treatment of incompressible deformation (Locking); B-bar method.

UNIT – V

FE PROCEDURES FOR LARGE DEFORMATION PROBLEMS:

Continuum mechanics—deformation gradient, polar decomposition, Green-Lagrange strain, rate of deformation, Cauchy stress, P-K stresses, Balance laws; Principle of objectivity and isotropy; Constitutive equations for hyperelasticity; Neo-Hookean model; FE formulation—Total Lagrangian and updated Lagrangian descriptions; Tangent Stiffness Matrix. Introduction to finite strain plasticity. Condition of impenetrability; Gap elements for modelling contact; Tangent stiffness matrix and force vectors for 2D frictionless contact problems.

TEXT BOOKS:

1. K. J. Bathe, *Finite Element Procedures*, Prentice-Hall of India Private Limited, New Delhi, 1996.
2. J. C. Simo and T. J. R. Hughes, *Computational Inelasticity*, Springer-Verlag New York, Inc., New York, 1998.

REFERENCE BOOKS:

1. O. C. Zienkiewicz and R. L. Taylor, *Finite Element Method: Volume 2 Solid Mechanics, Fifth Edition*, Butterworth-Heinemann, Oxford.
2. "Nonlinear Finite Elements for Continua and Structures", by T. Belytschko, W. K. Liu, and B. Moran, Wiley, NY.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED II Year I Sem.

VCE-R18

ADVANCES IN METALLURGY

(Program Elective – V)

Course Code: B4764

L	P	C
3	0	3

UNIT – I

Aspects of Physical Metallurgy: Crystal structure, systems and Bravais lattices, Indexing of lattice planes (Miller's Indices), Indexing of lattice directions, Coordination Number (Ligency), Density calculations and imperfections in crystals

UNIT – II

Study of Equilibrium diagrams for Fe-C systems, Cu - Bronze alloys i.e. Cu:Zn, Cu:Sn, Cu:Al etc., Developments in metallic materials like HSLA steels, maraging steels, dual phased steels, creep resisting steels, materials for high and low temperature applications, Nimerics, Inconels, Haste Alloys etc., Al, Ni alloys, Ti, Mg alloys.

UNIT – III

Heat Treatment of Nonferrous alloys, Heat Treatment of Tool steels

UNIT – IV

Orthodontal materials, Bio material, Prosthetic materials, Nano materials, superconducting materials, sports materials.

UNIT – V

Composites, ceramics, cermets, shape memory alloys their manufacturing techniques, advantages and limitations.

Surface coatings and their Tribological aspects. PVD, CVD, IVD ion implantation method

TEXT BOOKS:

1. *Engineering Metallurgy*, R. A. Higgins, Viva Books Pvt. Ltd.
2. *Elements of Material Science and Engineering*, Lawrence H., Van Nostrand Addison-Wesley Publishing Company.

REFERENCE BOOKS:

1. *Principles of Material Science and Engineering*, William F. Smith, McGraw-Hill Book Co.
2. *Material Science*, R. B. Gupta, Satya Publications, New Delhi.
3. *A Text Book of Material Science and Metallurgy*, O. P. Khanna, Dhanpat Rai and Sons, New Delhi.
4. *Material Science and Engineering an Introduction*, William D. Callister, Jr., John Wiley and Sons Inc.
5. *Smithells Metals Reference Book*, E. A. Brandes and G. B. Brook, Butterworth Heinemann.
6. *Biomaterials and Bioengineering Handbook*, Donald L. Wise, Marcel Dekker Inc.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED II Year I Sem.

VCE-R18

DESIGN FOR MANUFACTURING
(Program Elective – V)

Course Code: B4765

L	P	C
3	0	3

SYLLABUS

UNIT - I

Introduction Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design, Selection of Materials and Shapes.

UNIT - II

Properties of Engineering Materials, Selection of Materials – I, Selection of Materials – II, Case Studies – I, Selection of Shapes, Co-selection of Materials and Shapes, Case Studies – II.

UNIT – III

Selection of Manufacturing Processes, Review of Manufacturing Processes, Design for Casting, Design for Bulk Deformation Processes, Design for Sheet Metal Forming Processes, Design for Machining, Design for Powder Metallurgy, Design for Polymer Processing, Co-selection of Materials and Processes, Case-Studies – III

UNIT – IV

Design for Assembly, Review of Assembly Processes, Design for Welding – I, Design for Welding – II, Design for Brazing and Soldering, Design for Adhesive Bonding, Design for Joining of Polymers, Design for Heat Treatment, Case-Studies - IV

UNIT – V

Design for Reliability, Failure Mode and Effect Analysis and Quality, Design for Quality, Design for Reliability, Approach to Robust Design, Design for Optimization.

TEXT BOOKS:

1. *M F Ashby and K Johnson, Materials and Design - the art and science of material selection in product design, Butterworth-Heinemann, 03.*
2. *G Dieter, Engineering Design - a materials and processing approach, McGraw Hill, NY.*

REFERENCE BOOKS:

1. *M F Ashby, Material Selection in Mechanical Design, Butterworth-Heinemann, 1999.*
2. *T H Courtney, Mechanical Behavior of Materials, McGraw Hill, NY, 00.*
3. *K G Swift and J D Booker, Process selection: from design to manufacture, London: Arnold, 1997.*
4. *S S Rao, Engineering Optimization: theory and practice, John Wiley, NY, 1996.*
5. *G Boothroyd, P Dewhurst and W Knight, Product design for manufacture and assembly, John Wiley, NY: Marcel Dekkar, 1994.*
6. *J G Bralla, Handbook for Product Design for Manufacture, McGraw Hill, NY, 1998.*
7. *Houldcroft, Which Process – an introduction to welding and related processes and guide to their selection, Cambridge, Abington Pub., 1990.*
8. *ASTM Design handbook.*

VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

M. Tech. ED II Year I Sem.

VCE-R18

BUSINESS ANALYTICS

(Open Elective)

Course Code: B4901

L	P	C
3	0	3

SYLLABUS

UNIT - I

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

UNIT - II

TRENDINESS AND REGRESSION ANALYSIS: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT - III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT - IV

FORECASTING TECHNIQUES: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT - V

DECISION ANALYSIS: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

TEXT BOOKS:

1. *Business analytics Principles, Concepts, and Applications* by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. *Business Analytics* by James Evans, persons Education.

REFERENCE BOOKS:

1. *BUSINESS ANALYTICS 5e*, BY Albright |Winsto.

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED II Year I Sem.

VCE-R18

INDUSTRIAL SAFETY
(Open Elective)

Course Code: B4902

L	P	C
3	0	3

SYLLABUS

UNIT - I

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

UNIT - II

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

UNIT - III

WEAR AND CORROSION AND THEIR PREVENTION: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT - IV

FAULT TRACING: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT - V

PERIODIC AND PREVENTIVE MAINTENANCE: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

TEXT BOOKS:

1. *Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.*
2. *Maintenance Engineering, H. P. Garg, S. Chand and Company.*

REFERENCE BOOKS:

1. *Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.*
2. *Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.*

VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

M. Tech. ED II Year I Sem.

VCE-R18

OPERATIONS RESEARCH

(Open Elective)

Course Code: B4903

L	P	C
3	0	3

SYLLABUS

UNIT - I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT - II

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT - III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT - IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT - V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

TEXT BOOKS:

1. H.A. Taha, *Operations Research, An Introduction*, PHI, 2008.
2. H.M. Wagner, *Principles of Operations Research*, PHI, Delhi, 1982.

REFERENCE BOOKS:

1. J.C. Pant, *Introduction to Optimisation: Operations Research*, Jain Brothers, Delhi, 2008.
2. Hitler Libermann *Operations Research: McGraw Hill Pub. 2009.*
3. Pannerselvam, *Operations Research: Prentice Hall of India 2010.*
4. Harvey M Wagner, *Principles of Operations Research: Prentice Hall of India 2010.*

VARDHAMAN COLLEGE OF ENGINEERING
(AUTONOMOUS)

M. Tech. ED II Year I Sem.

VCE-R18

WASTE TO ENERGY
(Open Elective)

Course Code: B4904

L	P	C
3	0	3

SYLLABUS

UNIT - I

INTRODUCTION TO ENERGY FROM WASTE: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT - II

BIOMASS PYROLYSIS: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT - III

BIOMASS GASIFICATION: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers - Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT - IV

BIOMASS COMBUSTION: Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT - V

BIOGAS: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TEXT BOOKS:

1. *Non Conventional Energy*, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. *Biogas Technology - A Practical Hand Book* - Khandelwal, K. C. and Mahdi, S. S., Vol. I &II, Tata McGraw Hill Publishing Co. Ltd., 1983.

REFERENCE BOOKS:

1. *Food, Feed and Fuel from Biomass*, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2. *Biomass Conversion and Technology*, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.