ACADEMIC REGULATIONS
For
B. Tech. Four Year Degree Programme
(MR22 Regulations)

Effective from the Academic Year 2022-23 onwards

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)
(An UGC Autonomous Institution, Approved by AICTE and Affiliated to JNTUH, Hyderabad)
Recognized under section 2(f) &12 (B) of UGC Act 1956, Accredited by NAAC with 'A++' Grade (III Cycle)
Maisammaguda, Dhulapally (Post Via Kompally), Secunderabad - 500 100.
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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

MR22 – ACADEMIC REGULATIONS (CBCS)
for B.Tech. (REGULAR) DEGREE PROGRAMME

Applicable for the students of B.Tech. (Regular) programme admitted from the Academic Year *2022-23* onwards

The B.Tech. Degree of Jawaharlal Nehru Technological University Hyderabad, Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

VISION

To be a premier center of professional education and research, offering quality programs in a socio-economic and ethical ambience.

MISSION

- To impart knowledge of advanced technologies using state-of-the-art infrastructural facilities.

- To inculcate innovation and best practices in education, training and research.

- To meet changing socio-economic needs in an ethical ambience.

PROGRAMME OUTCOMES (POs)

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

1.

1. **Malla Reddy Engineering College (Autonomous) (MREC-A)** offers **Four** Year (**Eight** Semesters) **Bachelor of Technology (B.Tech**.) with Choice Based Credit System (CBCS) in the following Branches of Engineering with effect from the academic year **2022-23**.

S. No.	Branch Code	Branch	Intake
1	01	Civil Engineering (CE)	60
2	02	Electrical and Electronics Engineering (EEE)	60
3	03	Mechanical Engineering (ME)	60
4	04	Electronics and Communication Engineering (ECE)	180
5	05	Computer Science and Engineering (CSE)	240
6	12	Information Technology (IT)	60
7	62	Computer Science and Engineering (Cyber Security)	180
8	67	Computer Science and Engineering (Data Science)	180
9	66	Computer Science and Engineering (AI &ML)	180
10	69	Computer Science and Engineering (IOT)	60
11	73	Artificial Intelligence & Machine Learning(AI&ML)	60
12	25	Mining Engineering (Min.E)	60

2. Eligibility for Admission

2.1 Admission to the B.Tech programme shall be made either on the basis of the merit rank obtained by the qualifying candidate in entrance test conducted by the Telangana State Government (TSEAMCET) or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government of Telangana from time to time.

2.2 The medium of instructions for the entire B.Tech programme will be **English** only.

3. B.Tech. Programme Structure & Duration of Study

3.1 A student after securing admission shall pursue the B.Tech programme in a minimum period of **four** academic years (8 semesters) and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester. Further 2 years of extension is allowed for appearing examinations, failing which student shall forfeit seat in B.Tech. Course. The total credits for the entire B.Tech. programme is 160 as prescribed by AICTE. Each student shall secure 160 credits (with CGPA $\geq$ 5) required for the completion of the B.Tech programme and award of the B.Tech. degree*.

3.2 UGC/ AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are as listed below.

3.2.1 Semester Scheme:

Each B.Tech programme is of 4 academic years (8 Semesters), with the academic year being divided into two semesters of 22 weeks ($\geq$90 instructional days) each, having **'Continuous Internal Evaluation (CIE)'** and **'Semester End Examination (SEE)'** under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC. The Curriculum/ Course Structure is defined based on the model curriculum defined by AICTE.

3.2.2 Credit Courses:

All Subjects/ Courses are to be registered by a student in a semester to earn credits. Credits shall be assigned to each Subject/ Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) Structure, based on the following general pattern.

- One Credit - for one hour/ Week/ Semester for Theory/ Lecture (L) courses or Tutorials (T).
- One Credit - for two hours/ Week/ Semester for Laboratory/ Practical's (P) courses.

Courses like Environmental Sciences, Induction Programme, Constitution of India, Intellectual Property Rights, Gender Sensitization and students' activities like Internship are identified as Mandatory/Audit courses. These courses will not carry any credits.

3.2.3 Subject/ Course Classification:
All subjects/ courses offered for the B.Tech. Programmes are broadly classified as follows.
(a) Foundation Courses (FC)
(b) Core Courses (CC)
(c) Elective Courses (EC)
(d) Mandatory Courses (MC)
(e) Audit Courses (AC)

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry subjects
2		ES - Engineering Sciences	Includes Fundamental Engineering Subjects
3		HS – Humanities and Social Sciences	Includes subjects related to Humanities, Social Sciences and Management
4	Core Courses (CC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses (EC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
6		OE – Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
7	Core Courses	Project Work	B.Tech. Project or UG Project or UG Major Project or Project Stage I & II
8		Industry Training/ Internship/ Industry Oriented Mini-project/ Mini-Project/ Skill Development Courses	Industry Training/ Internship/ Industry Oriented Mini-Project/ Mini-Project/ Skill Development Courses
9		Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.

10	Minor Courses	-	1 or 2 Credit Courses (subset of HS)
11	Mandatory Courses (MC)	-	Mandatory Courses (non-credit)

3.2.4 Course Nomenclature:

The curriculum nomenclature or course structure grouping for each of the B.Tech. Programmes, is as listed below (along with AICTE specified range of total credits).

S. No.	Broad Course Classification	Course Group or Category	Course Description	Total Credits
1	Foundation Courses	Humanities, Social sciences & Management (HS)	English, humanities, social sciences, management	9.5
		Basic Sciences (BS)	Mathematics, Physics, Chemistry.	23
		Engineering Sciences (ES)	Fundamental Engineering Courses	21.5
2	Core Courses and Core activities	Program Core (PC)	Professional courses-core relevant to the discipline	58
		Project work (PW)	Minor & Major project (Institute / Industry), Internship (Industry/ research organization), Seminar.	18
3	Elective Courses	Program Electives (PE)	Professional courses-electives relevant to the discipline	18
		Open Electives (OE)	Electives from other departments and or emerging areas	12
4	Mandatory Courses	Mandatory Courses (MC)	Courses on Environmental Science and Rural Sensitization, Gender Sensitization, Constitution of India, Intellectual Property Rights	No Credits
	Total Credits			160

4.0 Course Registration

4.1   A 'Faculty Advisor or Counselor' shall be assigned a group of 20 students, who will advise the students on the Under Graduate Programme (UGP), its Course Structure and Curriculum, Choice / Option for Subjects / Courses, based on his competence, progress, pre-requisites and interest.

4.2   Academic section of the College invites 'Registration Forms' from students

within 15 days from the commencement of class work for the semester.

4.3 If the student submits ambiguous choices or multiple options or erroneous entries during 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.

4.4 Subject/ course options exercised through on-line registration are final and cannot be changed or inter-changed; 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 inevitable 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 a week after the commencement of class-work for that semester.

4.5 Dropping of subjects/ courses may be permitted, only after obtaining prior approval from the faculty advisor/ counselor 'within a period of 15 days' from the beginning of the current semester.

4.6 **Open Electives**: The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by his own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.) of subjects even in the forthcoming semesters.

4.7 **Professional Electives**: The students have to choose six Professional Electives (PE-I to VI) from the list of professional electives given.

4.8 For Audit Courses a **'Satisfactory Participation Certificate'** from the authorities concerned for the relevant semester is essential. No Marks or Credits shall be awarded for these activities.

4.9 For Mandatory Courses, a '**Satisfactory / Not Satisfactory'** is awarded based on the performance in both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).

5.0 Elective Subjects/ Courses to be offered

5.1 An Elective Subject/ Course may be offered to the students, ONLY IF a minimum of 40 students opt for the same. The maximum strength of a section is limited to75.

5.2 If more entries for registration of a subject come into picture, then the Head of the Department concerned shall decide, whether or not to offer such a subject/ course for two (or multiple) sections.

5.3 In case of options coming from students of other departments/ branches/ disciplines (not considering **open electives**), first **priority** shall be given to the

student of the '**parent department**'.

6.0 Attendance Requirements:

6.1 A student shall be eligible to appear for the Semester End Examinations, if he / she acquire a minimum of 75% of attendance in aggregate of all the Subjects/ Courses (including Non-Credit Courses) for that semester. **Two periods** of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject.

6.2 Condoning of shortage of attendance in aggregate up to 10% (>= 65% and< 75%) in each semester may be granted by the Academic Cell on genuine and **valid grounds** based on the student's representation with supporting evidence.

6.3 A stipulated fee prescribed by the College Academic Committee (CAC), shall be payable towards condoning of shortage of attendance.

6.4 Shortage of attendance below 65% in aggregate shall in NO case be condoned.

6.5 Students whose attendance is < 65% are not eligible to register for Semester End Examinations, they get detained and their registration for that semester shall stand cancelled including all academic credentials (internal marks etc.) of that semester. They will not be promoted to the next semester. They may seek re-registration for all those Subjects registered in that Semester in which he got detained, by seeking re-admission for that semester as and when offered; in case if there are any Professional Electives and/ or Open Electives, the same may also be **re-registered** if offered, however, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

6.6 If any student fulfills the attendance requirement in the present semester shall not be eligible for readmission into the same semester.

7.0 Academic Requirements:

The following Academic Requirements have to be satisfied, in addition to the attendance requirements mentioned in item No.6.

7.1 A student shall be deemed to have satisfied the Academic requirements and earned the credits allotted to each Subject/ Course, if student secures not less than 35% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades, this implies securing 'P' Grade or above in that Subject/ Course. If the student secured 'F' grade in any subject he/she can apply for recounting / revaluation by paying prescribed fee. If the student is not satisfied after the results declaration of recounting / revaluation he/she can apply for challenge valuation with the prescribed fee. College appoints a faculty member; student can bring another faculty member who taught the respective subject at least once (proof should be provided). The faculty member should be from any autonomous college affiliated to JNTUH or JNTUH constituent colleges.

7.2 A student shall be deemed to have satisfied the Academic Requirements and earned the credits allotted to to Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if he/ she secure not less than 40% marks (i.e 40 out of 100 allotted marks) in each of them. The student would be treated as failed, if he/ she :

(i) does not submit a report on his/ her Mini Project / Seminar / Project or does not make a presentation of the same before the Evaluation Committee as per schedule or (ii) secures less than 40% of marks in Mini Project/ Seminar/ Project evaluations.

He/ She may reappear once for each of the above evaluations, when they are scheduled again; if he/ she fails in such **'one-reappearance'** evaluation also, he/ she has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 **Promotion Rules:** Every student has to fulfil the Attendance and Academic requirements by securing the required credits against registered credits as shown below:

S. No.	Promotion	Conditions to be fulfilled
1.	First year first semester (I Semester) to first year second semester (II Semester)	• Regular course of study of first year first semester. (I Semester)
2.	First year second semester (II Semester) to second year first semester (III Semester)	• Regular course of study of first year second semester (II Semester). • Must have secured at least 50% credits up to first year second semester (II Semester) from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester (III Semester) to second year second semester (IV Semester)	• Regular course of study of second year first semester (III Semester)
4.	Second year second semester (IV Semester) to third year first semester (V Semester)	• Regular course of study of second year second semester (IV Semester). • Must have secured at least 60% credits up to second year second semester (IV Semester) from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5.	Third year first semester (V Semester) to third year second semester (VI Semester)	• Regular course of study of third year first semester (V Semester).

6.	Third year second semester (VI Semester) to fourth year first semester (VII Semester)	• Regular course of study of third year second semester (VI Semester). • Must have secured at least 60% credits up to third year second semester (VI Semester) from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7.	Fourth year first semester (VII Semester) to fourth year second semester (VIII Semester)	• Regular course of study of fourth year first semester (VII Semester).

7.4 A Student shall register for all subjects covering 160 credits as specified and listed (with the relevant Course/ Subject Classifications as mentioned) in the Course Structure, fulfils all the Attendance and Academic requirements for 160 credits securing a minimum of 'P' Grade (Pass Grade) or above in each subject and earn 160 credits securing SGPA ≥ 5.0 (in each semester) and CGPA (at the end of each successive semester) ≥ 5.0, to successfully complete the B.Tech Programme (including all mandatory courses). The performance of the student in these 160 credits shall be considered for the calculation of the final CGPA (**at the end of undergraduate programme**), and shall be indicated in the grade card / marks memo of IV-year II semester.

7.5 If a student registers for some more **'Extra Subjects'** (in the parent Department or other Departments/ Branches of Engineering) other than those listed subjects totaling to 160 credits as specified in the Course Structure of his/ her department, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required 160 credits) will not be taken into account while calculating the SGPA and CGPA. For such extra subjects registered, Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in items No.6 and 7.1 to7.4.

7.6 A student eligible to appear in the Semester End Examination in any Subject/ Course, but absent from it or failed (thereby failing to secure 'P' Grade or above) may reappear for that Subject/ Course at the supplementary examination as and when conducted. In such cases, his / her Internal Marks (CIE) assessed earlier for that Subject/ Course will be carried over and added to the marks to be obtained in the SEE supplementary examination, for evaluating his/ her performance in that subject.

7.7 When a student is detained due to shortage of attendance in any semester, he/ she may be re-admitted when the same semester is offered in the next academic year for fulfillment of academic requirements. The academic regulations under which student has been readmitted shall be applicable. However, no Grade Allotments or SGPA/ CGPA calculations will be done for that entire semester in which he/ she got detained.

7.8 When a student is detained due to lack of credits in any year, shall be promoted to the next academic year only after acquiring the required academic credits. The

academic regulations under which student has been readmitted shall be applicable to him.

8.0 Evaluation, Distribution and Weightage of Marks

8.1.1 The performance of a student in each semester shall be evaluated subject - wise (irrespective of credits assigned) for 100 marks for Theory, Practicals, Seminar, Drawing / Design, Mini Project, Project and Minor Courses etc. The Theory / Practical courses are evaluated with two components.

1. Continuous Internal Evaluation (CIE),
2. Semester End Examination (SEE).

The distribution of 40 Marks for CIE and 60 Marks for SEE.

8.2 Theory Courses:

8.2.1 Continuous Internal Evaluation (CIE):

The performance of a student in every subject/course (including practicals and Project) will be evaluated for 100 marks each, with 40 marks allotted for CIE (Continuous Internal Evaluation) and 60 marks for SEE (Semester End-Examination)

In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Each Mid-Term examination consists of two parts i) Part – A for 10 marks, ii) Part – B for 20 marks with a total duration of 2 hours as follows:

1. Mid Term Examination for 30 marks:
   a. Part - A : Objective/quiz paper for 10 marks.
   b. Part - B : Descriptive paper for 20 marks.

Mid - Term Examination – UG				
Part	Type of Questions	No. of Questions	Marks per Question	Total
Part - A	Multiple – Choice Questions	20	0.5	10
Part - B	Internal choice questions (Module-wise)	5	4	20
Mid Term Exam Total				**30**

The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (for 30 marks).

The remaining 10 marks of Continuous Internal Evaluation are distributed as:

2. Assignment for 5 marks. (Average of 2 Assignments each for 5 marks)
3. Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 5 marks.

The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus. First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second midterm examinations. The average of

the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the subject concerned for 5 marks before II Mid-Term Examination.

The weightage for the midterm examination shall be given as average of both mid-term examinations. The student shall appear for both midterm examinations, in case of any specific reason the student appears only one midterm examination, 50% weightage of that examination shall be considered.

The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

A student who has failed to secure 35% of CIE marks in a subject, may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

A student shall be given only one time chance to re-register for a maximum of two subjects in a semester:
- *If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Viva- voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.*

A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in next academic year.

In the event of the student taking this chance, his Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

8.2.2 Semester End Examination (SEE):
Semester End Examination (SEE) shall be conducted for all courses of B.Tech Programmes at the end of the Semester. Duration of the examination is 3 hours. The paper setting and evaluation of all courses carried out by external examiners. The examiners will be selected by the Chief Controller of Examinations/Principal, from the panel of examiners submitted by the head of the respective department.

Semester End Examination - UG				
Part	Type of Questions	No. of Questions	Marks per Question	Total
Part-A	compulsory question which consists of ten sub-questions from all modules	10	1	10
Part-B	Internal choice questions (Module-wise)	5	10	50
Total				60

8.3 Practical Courses:

8.3.1 Continuous Internal Evaluation (CIE):

8.3.2 For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks

2. 10 marks for viva-voce (or) tutorial (or) case study (or) application (or) poster presentation of the course concerned.

3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.

4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

8.3.3 Semester End Examination (SEE):

The Semester End Examination shall be conducted with an external examiner and the Internal Examiner. External examiner will be appointed by the Chief Controller of Examinations/Principal of the college. The external examiner should be selected from the outside college among the autonomous/reputed institutions from a panel of three examiners submitted by the concerned Head of the Department.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course and
5. 10 marks for viva-voce on concerned laboratory course.

The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Over all 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned subject but not scored minimum 35% of CIE marks(14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE

8.4 Engineering drawing :

For Drawing subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination.

The distribution of marks for CIE is given below

CIE for Engineering Drawing/ Engineering Graphics				
Part	Type of Questions	No. of Questions	Marks per Question	Total
Part - A	Day – to – Day Work			10
Mid – Term Examination				
Part - B	Internal choice questions (Module-wise)	5	6	30
Total				40

The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (for 40 marks).

The distribution of marks for SEE is given below

Semester End Examination - Engineering Drawing/ Engineering Graphics				
Part	Type of Questions	No. of Questions	Marks per Question	Total
Part-A	compulsory question which consists of ten sub-questions from all modules	10	1	10
Part-B	Internal choice questions (Module-wise)	5	10	50
Total				60

Machine Drawing:

For Drawing subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination.

The distribution of marks for **CIE** is given below

Type of Questions	No. of Questions	Marks per Question	Total
CIE for Machine Drawing			
Day to Day Work			10
I Mid Term Examination			
Part Drawing (4 out of 6)	4	7.5	30
Total			40

Type of Questions	No. of Questions	Marks per Question	Total
CIE for Machine Drawing			
Day to Day Work			10
II Mid Term Examination			
Assembly Drawing (1 out of 2)	1	30	30
Total			40

The average of the two Mid Term Examinations shall be taken as the final marks for Mid Term Examination (for 40 marks).

The distribution of marks for **SEE** is given below

Type of Questions	No. of Questions	Marks per Question	Total
SEE for Machine Drawing			
Part-A	compulsory question which consists of ten sub-questions from all modules	10	10
Part B (2 out of 4)	Part Drawing	5	10
Part C - (Compulsory Question)	Assembly Drawing	40	40
Total			60

The evaluation of courses having ONLY internal marks in II Year II Semester is as follows:

II Year II Semester Real-Time (or) Field-based Research Project course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations is the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

8.5 Projects:
8.5.1 Internship-III/Mini Project:

There shall be an Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after I-Year II Semester, II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be **NO internal marks** for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.

Project:
UG project work shall be carried out in two stages: Project Stage – I for approval of project before Mid-II examinations in IV Year I Semester and Project Stage – II during IV Year II Semester. Student has to submit project work report at the end of IV Year II Semester. The project shall be evaluated for 100 marks before commencement of SEE Theory examinations.

For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall approve the project work to begin before II Mid-Term examination of IV Year I Semester. The student is deemed to be not eligible to register for the Project work, if he does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

For Project Stage – II, the external examiner shall evaluate the project work for 60 marks and the internal project committee shall evaluate it for 40 marks. Out of 40 internal marks, the departmental committee consisting of Head of the Department, Project Supervisor and a Senior Faculty Member shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The topics for Industry Oriented Mini Project/ Internship/SDC etc. and the main Project shall be different from the topic already taken. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project, University selects an external examiner from the list of experts in the relevant branch submitted by the Principal of the College.

A student who has failed, may reappear once for the above evaluation, when it is scheduled again; if student fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

8.6.3 Seminar:

For Seminar presentation, the student shall collect the information on a specialized topic, prepare a report and submit to the department at the time of seminar presentation. The seminar presentation (along with the report) shall be evaluated by a committee consisting of Seminar coordinator and two senior faculty members with appropriate grade. The seminar report shall be evaluated internally for 100 marks. There shall be no semester end examination for the seminar.

8.6 Non-Credit Courses:

8.7.1 Mandatory Courses:

For mandatory courses of Environmental Science, Constitution of India, Intellectual Property Rights, and Gender Sensitization lab, a student has to secure 40 marks out of 100 marks (i.e. 40% of the 100 marks allotted) in the Continuous Internal Evaluation for passing the subject/course. These marks should also be uploaded along with the internal marks of other subjects.

No marks or letter grades shall be allotted for mandatory/non-credit courses. Only Pass/Fail shall be indicated in Grade Card.

8.7.2 Audit Courses:

For Audit Courses offered in any Semester, the student must submit a '**Participation Certificate**' from the concerned authorities. Internship program is also conducted under the category of Audit Courses. The student needs to submit a detailed report to the department after internship program. No marks or Letter Grade shall be allotted for these activities.

8.7.3 Acceleration of course work of final semester

In order to allow the bright and motivated students, a provision is made to complete the final semester three open elective subjects (I, II and III) in advance. These subjects are offered through MOOCs during III-Year II Semester (OE-I), IV-Year I Semester (OE-II) and IV year II Semester (OE-III) and credit transfer is permitted. These credits are shown in the Final Semester Grade card in order to calculate SGPA and CGPA.

This provision is made to allow the students for industry internship or to undertake projects in industry in the final semester. A student at the end of the II-Year II Semester having a CGPA of ≥ 7.0 without any backlogs is eligible to register for OE-I in Third Year Second semester. In the same way to register for OE-II and OE-III the student has to secure a CGPA of ≥ 7.0 at the end of the III- Year I Semester and III-Year II Semester respectively.

Departments will notify at the time of registration about the minimum and the maximum number of students to be enrolled for a particular open elective to be offered.

The list of open electives offered during that semester will be notified by the departments at the time of course work registration.

8.7.4 Massive Open Online Courses

8.7.4.1 To meet the global requirements by providing greater flexibility to choose a variety of courses to inculcate the habit of self-learning, in compliance with the UGC guidelines, Massive Open Online Courses (MOOCs) shall be provided during the period of study.

8.7.4.2 The students are allowed to register MOOCs courses up to a maximum of 15% of total credits under open electives/ professional electives courses, subjected to the approval by the concerned Head of the Department. The proposed MOOCs would be additional choices in the program elective/open elective group of courses subject to their offering by the department as well as their availability in MOOCs platform during the respective semester. However, the Board of studies of the respective department shall approve contemporary courses from time to time under MOOCs.

8.7.4.3 Concerned departments shall declare the list of the courses that a student can pursue at the beginning of the semester. Students interested in pursuing MOOCs shall register the course at their department at the beginning of the semester against the courses that are announced by the department. Course progress shall be monitored by the course coordinator of the department. Each of the course shell be of minimum 12 weeks in duration.

8.7.4.4 The Students registered for MOOC Courses shall be Evaluated for CIE as per 8.2.1. The SEE evaluation will be considered as per 8.2.2. If the students fails to clear the subject, he/she has to re- register for the course.

8.7.4.5 The grade equivalency for MOOCs courses shall be recommended by the respective BOS chairperson and is to be approved by the Chairman, academic council.

9.0 Grading Procedure

9.1 Grades will be awarded to indicate the performance of each student in each Theory Subject, Laboratory/Practicals/ Industry-Oriented Mini Project/Internship/SDC (Skill Development Center) and Project Stage, based on the % of marks obtained in CIE + SEE both taken together as specified in Item No. 8 and a corresponding Letter Grade shall be given.

9.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed.

% of Marks	Grade Points	Letter Grade
≥90	10	(Out Standing)
≥80 to < 90	9	A$^+$ (Excellent)
≥70 to < 80	8	A (Very Good)
≥60 to < 70	7	B$^+$ (Good)
≥50 to <60	6	B (Average)
≥40 to < 50	5	C (Pass)
< 40	0	F (Fail)
Absent	0	Ab

9.3 A student obtaining **'F'** Grade in any subject shall be considered **'Failed'** and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE) as and when conducted. In such cases, his / her Internal Marks (CIE Marks) in those subject(s) will remain same as those he / she obtained earlier.

9.4 A Letter Grade does not imply any specific % of marks.

9.5 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA / CGPA Improvement'. However, he / she has to repeat all the Subjects/ Courses pertaining to that semester, when he / she is detained (as listed in Items Nos.7.7 &7.8).

9.6 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course (excluding Mandatory non-credit Courses).Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits …For a Course

9.7 The Student passes the Subject/ Course only when he / she gets GP ≥ 5('C' Grade or above).

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from all Subjects/ Courses registered in a semester by the Total Number of Credits registered during that semester. SGPA is rounded off to two decimal places. SGPA is thus computed as

$$SA = \left\{ \sum_{i=1}^{N} C_i G_i \right\} / \left\{ \sum_{i=1}^{N} C_i \right\} \quad \text{… for each semester}$$

where 'i' is the subject indicator index (takes into account all subjects in a semester), 'N' is the number of subjects registered for the semester (as specifically required and listed under the Course Structure of the parent department) is the number of credits allotted to the i^{th}subject and represents the Grade Points (GP)corresponding to the Letter Grade awarded for that i^{th}subject.

9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in all registered courses in ALL semesters and the total number of credits registered in all the semesters. CGPA is rounded off to two decimal places. CGPA is thus computed from the II semester onwards, at the end of each semester, as per the formula.

$$SA = \left\{ \sum_{j=1}^{M} C_j G_j \right\} / \left\{ \sum_{j=1}^{M} C_j \right\} \quad \text{… for all 'S' semesters registered}$$

(i.e., up to and inclusive of 'S' semesters, S ≥ 2)

where 'M' is the total number of subjects (as specifically required and listed under the course structure of the parent department) the student has registered from the 1^{st}semester onwards up to and inclusive of the semester 'S' (obviously M > N), 'j' is the subject indicator index (takes in to account all subjects from '1' to 'S' semesters) is the number of credits allotted to the j^{th}subject, and represents the Grade Points (GP) corresponding to the Letter Grade awarded for that j^{th}subject. After registration and completion of I Year I Semester however, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

ILLUSTRATION OF CALCULATION OF SGPA

Course/ Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	3	A	8	3 x 8 = 24
Course 2	3	O	10	3 x 10 = 30

Course 3	3	C	5	3 x 5 = 15
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	1.5	B	6	1.5 x 6 = 09
Course 7	1.5	A	8	1.5 x 8 = 12
Course 8	2	A	8	2 x 8 = 16
	Total = 20			Total Credit Points = 151

SGPA = 151/20 = 7.55

ILLUSTRATION OF CALCULATION OF CGPA:

Semester	Credits	SGPA	Credits X SGPA
Semester I	21	7	21 X 7 = 147
Semester II	19	6	19 X 6 = 114
Semester III	22	6.5	22 X 6.5 = 143
Semester IV	20	6	20 X6 = 120
Semester V	22	5.75	22 X 5.75 = 126.5
Semester VI	18	7.25	18 X 7.25 = 130.5
Semester VII	18	8	18 X 8 = 144
Semester VIII	20	8.5	20 X 8.5 = 170
	160		1095

CGPA = 1095/160 = 6.84

The calculation process of CGPA illustrated above will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. programme.

9.10 For merit ranking or comparison purposes or any other listing, only the rounded off values of the CGPAs will be used.

9.11 For calculations listed in Item Nos.9.6 to 9.10, performance in failed Subjects/ Courses (securing 'F' Grade) will also be taken into account and the credits of such Subjects/Courses will also be included in the multiplications and summations. However, Mandatory Courses will not be taken into consideration.

9.12 Passing Standards:

9.12.2 A student shall be declared successful or 'passed' in a semester, only when he / she gets a SGPA ≥ 5.00 (at the end of that particular semester); and a student shall be declared successful or 'passed' in the entire B.Tech Programme, only when he / she gets a CGPA ≥ 5.00; subject to the condition that he / she secures a GP ≥ 5 ('C' Grade or above) in every registered Subject/ Course in each semester (during the entire B.Tech Programme) for the award of degree, as required.

9.12.3 After the completion of each semester, a grade card or grade sheet shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits, grade earned, etc.) and credits earned. **There is NO exemption of credits in any case.**

9.12.4 In spite of securing 'P' Grade or above in some (or all)Subjects/ Courses in any semester, if a student receives a SGPA < 5.00 and/ or CGPA < 5.00 at the end of such a semester, then he / she 'may be allowed' (on the 'specific recommendations' of the Head of the Department and subsequent approval from the Principal) (i) to go into the next subsequent semester (subject to fulfilling all other attendance and academic requirements as listed under Item Nos. 7&8);(ii) to 'improve his / her SGPA of such a semester (and hence CGPA) to 5.00 or above', by reappearing for one or more (as per student's choice) of the same course(s) in which he / she has secured 'P' Grade(s) in that semester, at the Supplementary Examinations to be held in the next subsequent semester(s). In such cases, his / her Internal Marks (CIE Marks) in those subject(s) will remain same as those he / she obtained earlier. In these considerations, the newly secured Letter Grades will be recorded and taken into account for calculation of SGPA and CGPA, only if there is an improvement.

9.12.5 After the completion of each semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the registered students of that semester, indicating the Letter Grades and credits earned. It will show the details of the courses registered (Course Code, Title, No. of Credits and Grade Earned etc.), Credits earned, SGPA and CGPA.

10   Declaration of Results

10.1 Computation of SGPA and CGPA are done using the procedure listed in items 9.6 to 9.12.

10.2 For final % of marks equivalent to the computed final CGPA, the following formula may be used …

$$\textbf{\% of Marks = (final CGPA – 0.5) x 10}$$

11   Award of Degree

11.1 A student who register for all the specified courses as listed in the Course Structure, satisfies all the course requirements, passes all the examinations prescribed in the entire B.Tech Programme within the specified period (refer 4.1) and secures the required 160 Credits (with CGPA ≥ 5.0) shall be declared to have '**Qualified'** for the award of the B.Tech. Degree in the chosen branch of engineering as selected at the time of admission.

11.2 A student who qualifies for the award of the degree as listed in Item 11.1, shall be placed in one of the following classes:

Class Awarded	CGPA
First Class with Distinction	≥ 8.00
First Class	≥ 7.0 and < 8.00
Second Class	≥ 6. 0 and < 7.0
Pass Class	≥ 5.00 and < 6.0

11.3 A student with final CGPA (at the end of the B.Tech Programme) <5.00 will not be eligible for the award of the degree.

11.4 Students will be eligible for the award of '**Gold Medal**', if he/she should have passed all the subjects/courses in first appearance within the first academic years (or eight sequential semesters) from the date of commencement of first year first semester and should have secure CGPA ≥ 8.00 at the end of eight sequential semesters.

11.5 A student will be eligible to get under graduate with honours or additional minor engineering if he/she completes an additional 20 credits through MOOCs.

AWARD OF 2-YEAR B.TECH. DIPLOMA CERTIFICATE

1. A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) upto B.Tech. II Year II Semester, if the student want to exit the 4-Year B.Tech. program and *requests for the 2 -Year* B. Tech. (*UG) Diploma Certificate.*

2. The student **once opted and awarded 2-Year UG Diploma Certificate, the student will be permitted to join** in B. Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree ONLY in the next academic year along with next batch students. *However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of classwork for that semester.*

3. *The students, who exit the 4-Year B. Tech. program after II Year of study and wish to re-join the B.Tech. program, must submit the 2 -Year B. Tech. (UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.*

4. A student may be permitted to take one year break after completion of II Year II Semester or B. Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

12 Withholding of Results

If the student has not paid fees to college at any stage or has pending dues against his / her name due to any reason whatsoever or if any case of indiscipline is pending against him, the result of the student may be with-held and he / she will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

13 Transitory Regulations

A. **For students detained due to shortage of attendance**:

1. A student who has been detained in I year of MR18/MR20/MR21 regulations due to lack of attendance, shall be permitted to join I year I Semester of MR22 regulations and he / she is required to complete the study of B.Tech Programme

within the stipulated period of eight academic years from the date of first admission in I Year.

2. A student who has been detained in any semester of II, III and IV years of MR18 /MR20 /MR21 regulations for want of attendance, shall be permitted to join the corresponding semester of MR22 regulations and is required to complete the study of B.Tech., within the stipulated period of eight academic years from the date of first admission in I Year. The MR22 academic regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further transitory regulations.

B. **For students detained due to shortage of credits**:

1 A student of MR18/MR 20/MR21 regulations, who has been detained due to lack of credits, shall be promoted to the next semester of MR22 regulations only after acquiring the required credits as per the corresponding regulations of his/her first admission. The student is required to complete the B.Tech Programme within the stipulated period of eight academic years from the year of first admission. The MR22 academic regulations are applicable to a student from the year of readmission onwards. See rule (C) for further Transitory Regulations.

C. **For readmitted students in MR22 regulations**:

1 A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.

2 The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including MR22 regulations. **There is NO exemption of credits in any case**. The performance evaluation of the student will be done after the exemption of two subjects if total credits acquired are ≤ 160, (see item 7.5).

3 If a student readmitted to MR22 regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in MR22 regulations will be substituted by another subject to be suggested by the College Academic Committee (CAC).

Note: If a student readmitted to MR22 regulations, has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in MR22 regulations, the departments concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

14 Student Transfers

14.1 There shall be no branch transfers after the completion of admission process.

14.2 The students seeking transfer to MALLA REDDY ENGINEERING COLLEGE (Autonomous)-MREC(A) from various other Universities/ Institutions have to pass the failed subjects which are equivalent to the subjects of MREC(A) and also pass the subjects of MREC(A) which the students have not studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of MREC(A), the students have to study those subjects in MREC(A) inspite of the fact that those subjects are repeated.

14.3 The transfer students from other Universities / Institutions to MREC(A) who are on rolls will be provided one chance to write internal examinations in the failed subjects and/or subjects not studied as per the clearance letter issued by the JNTUH.

14.4 The autonomous affiliated colleges have to provide one chance to write the internal examinations in the **equivalent subject(s)** to the students transferred from other universities/institutions to JNTUH autonomous affiliated colleges who are on rolls, as per the clearance (equivalence) letter issued by the University.

15. Transitory Regulations

A. For students detained due to shortage of attendance:
1. A Student who has been detained in I year of MR20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of MR22 Regulations and he is required to complete the study of B.Tech. programme within the stipulated period of eight academic years from the date of first admission in I Year.

2. A student who has been detained in any semester of II, III and IV years of MR20 regulations for want of attendance, shall be permitted to join the corresponding semester of MR22 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The MR22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:
3. A student of MR20 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of MR22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both MR20 & MR22 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The MR22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in MR22 Regulations:
4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including MR22 Regulations. **There is NO exemption of credits in any case**.
6. If a student is readmitted to MR22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in MR22 Regulations will be substituted by another subject to be suggested by the college academic administration.

Note:
If a student readmitted to MR22 Regulations and has not studied any courses/topics in his/her earlier regulations of study which is prerequisite for further subjects in MR22 Regulations, then the college shall conduct remedial classes to cover those courses/topics for the benefit of the students.

16. Transfer of students from the Constituent Colleges of JNTUH or from other Colleges / Universities:

a) Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis.

b) There shall be no branch transfers after the completion of admission process.

c) The students seeking transfer to MREC from various other Universities/institutions have to pass the failed courses which are equivalent to the courses of MREC, and also pass the courses of MREC which the students have not studied at the earlier institution. Further, though the students have passed some of the courses at the earlier institutions, if the same courses are prescribed in different semesters of MREC, the students have to study those courses in MREC in spite of the fact that those courses are repeated.

d) The transferred students from other Universities/institutions to MREC who are on rolls are to be provided one chance to write the CBT (internal marks) in the **equivalent course(s)** as per the clearance (equivalence) letter issued by the University.

17. General Rules

a) The academic regulations should be read as a whole for the purpose of any interpretation.

b) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.

d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

18. Scope

(i) Where the words "he", "him", "his", occur in the write – up of regulations, they include "she", "her", "hers".

(ii) Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".

(iii) The academic regulations should be read as a whole, for the purpose of any interpretation.

(iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Committee headed by the Principalwill be considered as final.

Academic Regulations for B.Tech.(Lateral Entry Scheme)
w.e.f the A Y 2023-24

1. **Eligibility for award of B. Tech. Degree(LES)**

   The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.

2. The student shall register for 120 credits and secure 120 credits with CGPA ≥ 5 from II year to IVyear B.Tech. Programme (LES) for the award of B.Tech. degree.

3. The students, who fail to fulfill the requirement for the award of the degree in six academic years from the year of admission, shall forfeit their seat in B.Tech. Programme.

4. The attendance requirements of B. Tech. (Regular) shall be applicable to B.Tech.(LES).

5. **Promotion Rule:**

Sl.No.	Promotion	Conditions to be fulfilled
1	Second year first semester (III Semester) to second year second semester (IV Semester)	Regular course of study of second year first semester (III Semester).
2	Second year second semester (IV Semester) to third year first semester (V Semester).	**(i)** Regular course of study of second year second semester (IV Semester) **(ii)** Must have secured at least 60% credits up to second year second semester (IV Semester) from all the relevant regular and supplementary examinations, whether the
3	Third year first semester (V Semester) to third year second semester (VI Semester)	Regular course of study of third year first semester (V Semester).
4	Third year second semester (VI Semester) to fourth year first semester (VII Semester)	**(i)** Regular course of study of third year second semester (VI Semester) **(ii)** Must have secured at least 60% credits up to third year second semester (VI Semester) from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester (VII Semester) to fourth year second semester (VIII Semester)	Regular course of study of fourth year first semester (VII Semester)

6. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

7. LES students are not eligible for 2-Year B. Tech. Diploma Certificate.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

Sl.No.	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the course of the examination)	Expulsion from the examination hall and cancellation of the performance in that course 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 candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that course 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 that course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that semester. The hall ticket of the candidate shall be cancelled.
3	Impersonates any other candidate in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original student who has been impersonated, shall be cancelled in all

		the courses of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The student is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the Chief Controller of Examinations (CCE) / Controller of Examinations (CE) / Assistant Controller of Examinations (ACE) / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over

	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-incharge, 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	to the police and a police cases 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 course and all the other courses the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme 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 course and all other courses the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate 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.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the student has appeared including practical examinations and project work of that SEE.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the CCE for further action toward suitable punishment.	

Note: *The student(s) found indulging in malpractices during the CIE also will be punished based on the recommendations of the College Academic Committee.*

Malpractices identified by squad or special invigilators
1. Punishments to the students as per the above guidelines.

Academic Regulations for B.Tech. with Minors Programme under MR22
(Applicable for Batches Admitted from 2022-23)

1. Objectives

The key objectives of offering B. Tech. with Minor program are:
- To expand the domain knowledge of the students in one of the other programmes of engineering.
- To increase the employability of undergraduate students keeping in view of better opportunity in interdisciplinary areas of engineering & technology.
- To provide an opportunity to students to pursue their higher studies in the inter-disciplinary areas in addition to their own programme of study.
- To offer the knowledge in the areas which are identified as emerging technologies/thrust areas of Engineering.

2. Academic Regulations for B.Tech. Degree with Minor programmes

a) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4 -Years B.Tech. programme.
b) For B.Tech. with Minor, a student needs to earn additional 18 credits (over and above the required 160 credits for B.Tech. degree). All these 18 credits need to be completed in III year and IV year only.
c) After registering for the Minor programme, if a student is unable to earn all the required 18 credits in a specified duration (twice the duration of the course), he/she shall not be awarded Minor degree. However, if the student earns all the required 160 credits of B.Tech., he/she will be awarded only B.Tech. degree in the concerned programme.
d) There is no transfer of credits from Minor programme courses to regular B.Tech. degree course and vice versa.
e) These 18 credits are to be earned from the additional Courses offered by the host department in the college as well as from the MOOCS platform.
f) For the course selected under MOOCS platform following guidelines may be followed:
    i. Prior to registration of MOOCS courses, formal approval of the courses, by the University is essential. University before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
    ii. Minimum credits for MOOCS course must be equal to or more than the credits specified in the Minor course structure provided by the University.
    iii. Only Pass-grade/marks or above shall be considered for inclusion of grades in minor grade memo.
    iv. Any expenses incurred for the MOOCS courses are to be met by the students only.
g) The option to take a Minor programme is purely the choice of the student.

h) The student shall be given a choice of withdrawing all the courses registered and/or the credits earned for Minor programme at any time; and in that case the student will be awarded only B.Tech. degree in the concerned programme on earning the required credits of 160.

i) The student can choose only one Minor programme along with his/her basic engineering degree. A student who chooses an Honors programme is not eligible to choose a Minor programme and vice-versa.

j) A student can graduate with a Minor if he/she fulfils the requirements for his/her regular B.Tech. programme as well as fulfils the requirements for Minor programme.

k) The institute shall maintain a record of students registered and pursuing their Minor programmes, minor programme-wise and parent programme -wise. The same report needs to be sent to the University once the enrolment process is complete.

l) The institute / department shall prepare the time-tables for each Minor course offered at their respective institutes without any overlap/clash with other courses of study in the respective semesters.

3. Eligibility conditions for the student to register for Minor programme

a. A student can opt for B.Tech. programme with Minor programme if she/he has no active backlogs till II Year I Semester (III semester) at the time of entering into III year I semester.

b. Prior approval of mentor and Head of the Department for the enrolment into Minor programme, before commencement of III year I Semester (V Semester), is mandatory

c. If more than 50% of the students in a programme fulfil the eligibility criteria (as stated above), the number of students given eligibility should be limited to 50%.

4. Registration for the courses in Minor Programme

a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.

b) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have studied/registered for regular B.Tech. programme. No course should be identical to that of the regular B.Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

c) The maximum No. of courses for the Minor is limited to two (three in case of inclusion of lab) in a semester along with regular semester courses.

d) The registration fee to be collected from the students by the College is **Rs. 1000/-** per one credit.

e) A fee for late registration may be imposed as per the norms.

5. Minor courses and the offering departments

S. No.	Minor Programme	Eligible programme of students	@Offering Department	Award of Degree
1	CSE	CE, EEE, ME, ECE, Mi.E	CSE / CSE (AI&ML) /B.Tech. (AI&ML)/ B.Tech. (AI)/ B.Tech. CSE(AI)	"B.Tech. in programme name with Minor in CSE"

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

COURSE STRUCTURE and syllabus – B. Tech Mining ENGINEERING
(MR22 Regulations - Effective from Academic Year 2022 – 23 onwards)

			SEMESTER – I				
S.No	**Category**	**Course Code**	**Name of the Subject**	**Contact hours/week**			**Credits**
				L	**T**	**P**	
1	HSMC	C0HO1	English	3	0	0	3
2	BSC	C0B05	Linear Algebra and Differential Equations	3	1	0	4
3	ESC	C0501	Programming for Problem Solving	3	0	0	3
4	ESC	C0201	Basic Electrical and Electronics Engineering	3	0	0	3
5	ESC	C0502	Programming for Problem Solving Lab	0	0	2	1
6	BSC	C0H02	English Language and communications Skills lab	0	0	2	1
7	ESC	C0302	Engineering Workshop	0	0	2	1
8	ESC	C0202	Basic Electrical and Electronics Engineering LAB	0	0	2	1
			Total	**12**	**1**	**8**	**17**
			Total Contact Hours		**29**		

			SEMESTER – II				
S.No	**Category**	**Course Code**	**Name of the Subject**	**Contact hours/week**			**Credits**
				L	**T**	**P**	
1	BSC	C0B17	Engineering Chemistry	3	1	0	4
2	ESC	C0301	Engineering Graphics	3	0	0	3
3	BSC	C0B12	Engineering Physics	3	1	0	4
4	ESC	C0303	Engineering Mechanics	3	0	0	3
5	BSC	C0B06	Vector Calculus and Numerical Techniques	3	1	0	4
6	ESC	C0527	Basic Python Programming Lab	0	0	4	2
7	BSC	C0B13	Engineering Physics Lab	0	0	2	1
8	BSC	C0B18	Engineering Chemistry Lab	0	0	2	1
9	ESC	C0304	Engineering Mechanics Lab	0	0	2	1
							23
			Total Contact Hours		**23**		

S.No	Category	Course Code	Name of the Subject	L	T	P	Credits
SEMESTER – III							
11.	ESC	C0314	Fluid Mechanics and Hydraulic Machines	3	0	0	3
12.	ESC	C0313	Machine Drawing	3	0	0	2
13.	ESC	C0354	Basic Mechanical Engineering	3	0	0	2
14.	ESC	C0252	Electrical Machines and Controls	2	0	0	3
15.	PCC	C2501	Mine Surveying	3	0	0	3
16.	PCC	C2502	Development of Mineral Deposits	2	0	0	3
17.	ESC	C0318	Fluid Mechanics and Hydraulic Machines Lab	0	0	2	1
18.	ESC	C0561	Fundamentals of Data Structures Lab	0	0	2	2
19.	PCC	C2503	Mine Surveying Lab	0	1	2	1
20.	MCC	C00M2	Environmental Sciences	2	0	0	0
			Total	18	1	6	**20**
			Total Contact Hours		25		

S.No	Category	Course Code	Name of the Subject	L	T	P	Credits
SEMESTER – IV							
1.	BSC	C0B02	Probability and Statistics	3	0	0	3
2.	ESC	C0306	Mechanics of Solids	3	0	0	3
3.	PCC	C2504	Mining Geology	3	0	0	3
4.	PCC	C2505	Mine Environmental Engineering-I	3	0	0	3
5.	PCC	C2506	Drilling and Blasting	3	0	0	3
6.	PCC	C2507	Mining Machinery-I	2	0	0	2
7.	ESC	C2353	Mechanics of Solids Lab	0	0	2	1
8.	PCC	C2508	Mining Geology Lab	0	0	2	1
9.	ESC	C0562	Object Oriented Programming Through JAVA Lab	0	1	2	2
10.	MCC	C00M1	Gender Sensitization	2	0	0	0
			Total	19	1	6	**21**
			Total Contact Hours		26		

			V SEMESTER	
SL.NO	**CATEGORY**	**SUBJECT CODE**	**SUBJECT NAME**	**Credits**
1	PCC	C2509	Mine Environmental Engineering - II	2
2	PCC	C2510	Underground Coal Mining	3
3	PCC	C2511	Rock Mechanics	3
4	PCC	C2512	Mining Machinery - II	3
5	PCC	C2513	Surface Mining Technology	3
6	PEC-I	C2514	Rock Excavation Engineering	3
		C2515	Mineral Exploration	
		C2516	Small Scale Mining and Marine Engineering	
		C2517	Eco Friendly Mining	
		C2518	Tunneling Engineering	
7	PCC	C2533	Mine Environmental Engineering LAB	1
8	PCC	C2519	Mining Machinery Lab	1
9	MC	C00M3	Quantitative Property Rights	0
10	MC	C00M6	Intellectual Property Rights	0
Total Credits				**20**

			VI SEMESTER	
SL.NO	**CATEGORY**	**SUBJECT CODE**	**SUBJECT NAME**	**Credits**
1	HSMC	C0H10	Industrial Management	3
2	PCC	C2520	Mine Economics	3
3	PCC	C2521	Computer Applications in mining	3
4	PCC	C2522	Underground Metal Mining	3
5	PEC-II	C2528	Environmental Impact Sustainable Mining	3
		C2529	Mine Subsidence Engineering	
		C2530	Advanced Coal Mining and Mechanization	
		C2531	Waste Management in mines	
		C2532	Mine Automation and Data Analytics	

7	OEC-I			3
8	HSMC	C0H03	Advanced English Communication Skills Lab	1
9	PCC	C2534	Rock Mechanics Lab	1
10	MC	C00M5	Constitution of India	0
11	PROJ		Industry Oriented mini project/internship	2
Total Credits				**22**

VII SEMESTER				
S.NO	CATEGORY	SUBJECT CODE	SUBJECT NAME	Credits
1	PCC	C2535	Mine Legislation	2
2	PCC	C2536	Mineral Processing	2
3	PEC-III	C2523	Mine Ground Control	3
		C2524	Long wall Mining	
		C2525	Mine Systems Engineering	
		C2526	Rock fragmentation Engineering	
		C2527	Surface mine planning	
4	PEC-IV	C2537	Disaster Management	3
		C2538	Rock Slope Engineering	
		C2539	Mine Planning and Design	
		C2540	Dimensional stone mining	
		C2541	Mine management & economics	
5	OEC-II	C0159	Green Building	3
6	PCC	C2540	Mineral Processing Lab	1
7	PCC	C2541	Computer application in Mining Lab	1
8	PROJ-1	C00P1	STAGE -1	2
Total Credits				17

VIII SEMESTER				
S.NO	CATEGORY	SUBJECT CODE	SUBJECT NAME	Credits
1	PEC-V	C2542	Advanced Surface Mining	3
		C2543	Advanced Metal Mining and Mechanization	
		C2544	Material Handling	
		C2545	Mine Administration	
		C2546	Underground metal mining methods	

2	OEC-III			3
3	PEC-VI	C2547	Numerical Modeling in Mining	3
		C2548	Geo-statistics	
		C2549	Coal Bed Methane and Underground Coal Gasification	
		C2550	Risk Management in Mines	
		C2551	Environmental Impact and Sustainable Mining.	
4	PROJ-2	C25P02	Major project WITH SEMINAR	11
Total Credits				20

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B.Tech. I Semester	
Code: C0H01	ENGLISH (Common for CE,EEE,ME,ECE,CSE,CSE(AIML) CSE(DS), CSE (CS), CSE(IOT),IT and Min.E)	L	T	P
Credits: 3		3	-	-

Course Objectives:

The objective of this course is to improve the English Language and Literary competence of the students. The course provides requisite insights into grammar, vocabulary, prose, and short stories. Further, it also helps in developing the skills of Reading and Writing. The course also equips students to study their academic subjects more effectively using the theoretical and practical components of the English language and literature.

MODULE – I

Speech   : "Go Kiss the World" by Subroto Bagchi

Poem   : **"**Leisure" by W. H. Davies

Vocabulary: Formation of Words, Prefixes, Suffixes, and Root Words

Grammar   : Articles and Prepositions

Reading   : Skimming and Scanning

Writing   : Introduction to Writing Skills, Characteristics of Effective Writing

MODULE – II

Short story : "Gift of Magi" by O' Henry

Poem   : **"**No Man is an Island" by John Donne
Vocabulary: One Word Substitutions; Synonyms and Antonyms
Grammar   : Degrees of Comparison, Voice –Exercises
Reading   : Intensive Reading and ExtensiveReading

Writing   : Paragraph Writing- Cohesive devices; Jumbled Sentences; Punctuation

Module – III
Essay   : "Lucidity, Simplicity, Euphony" by W. Somerset Maugham

Poem   : **"**The Mask" by Maya Angelou

Grammar   : Tense and Aspect

Vocabulary: Homonyms, Homophones, Homographs
Reading   : Reading for Topic andTheme
Writing : Letter Writing

MODULE – IV

Short story : "The Night Train at Deoli" by Ruskin Bond

Poem   **: "**Gift of India" by Sarojini Naidu
Grammar   **:** Question Tags; Concord

Vocabulary: Idiomatic Expressions; Phrasal Verbs

Reading   **:** Reading for Interpretation

Writing   **:** Essay Writing, Describing, Defining and Classifying

MODULE – V

Essay   **:** "Toasted English" by R. K. Narayan

Poem   **:** "If" by Rudyard Kipling

Grammar   **:** Direct and Indirect Speech, Misplaced Modifiers

Vocabulary: Redundancies and Clichés

Reading   **:** Reading for Specific Purposes, Reading Comprehension practice

Writing   **:** Paraphrasing & Summarizing,

* Exercises from the texts not prescribed shall also be used for classroom tasks.

Prescribed Textbook:

Reference Books:

1. Azar, Betty and <u>Stacy A, Hagen</u>. *Understanding and Using English Grammar*. 4th edition, Foundation Books, 2009.
2. Chaudhuri, Santanu S. *Learn English: A Fun Book of Functional Language, Grammar andVocabulary*. Tata McGraw Hill Education, New Delhi, 2013.
3. Eastwod, John. <u>*Oxford Guide to English Grammar.* 4th edi</u>tion, Oxford University Press, 1994.
4. Field, Marion**.** *Improve Your Written English*. 5th Edition. How to Books, UK, 2009.
5. Leech, Geoffrey and Svartvik, J. *A Communicative Grammar of English*. 3rd edition,

Routledge, 2013.

Related Websites:

1. http://www.slideshare.net/aszardini/word-formationroot-words-prefixes-and-suffixes
2. http://www.scribd.com/doc/37085980/Circulars-Circular-Letters-Notices-Memo#scribd.
3. http://www.zsme.tarnow.pl/jezykiobce/wp-content/uploads/2013/11/writing-letters1.pdf.

Course Outcomes:

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

1. Use Written And Spoken English Considerably Well For Academic Purposes.

2. Communicate In Enrich Accurately And Fluently.

3. Employ Extensive And Intensive Reading Skills.

4. Gain Confidence In Writing For Academic And Real Life Situations.

5. Use Standard Grammar, Punctuation, And Spelling In Technical Documents.

<table>
<tr><td colspan="13" align="center">CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
<tr><td rowspan="2">COS</td><td colspan="12" align="center">Programme Outcomes(POs)</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>PO9</td><td>PO10</td><td>PO11</td><td>PO12</td></tr>
<tr><td>CO1</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO2</td><td>3</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO3</td><td>3</td><td>2</td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO5</td><td>2</td><td>2</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomos)	B.Tech. I Semester		
Code:C0B05	Linear Algebra and Differential Equations (Common For CE, ME&MINING)	L	T	P
Credits: 4		3	1	-

Prerequisites: Matrices, Differentiation, and Integration

Course Objectives:

1. To learn rank of the matrix and its application to consistency of system of linear equations
2. To learn Eigen Values, Eigen Vectors and nature of Quadratic forms.
3. To learn the concept of the mean value theorems, partial differentiation and maxima and minima.
4. To learn methods of solving differential equations and its applications to basic engineering problems.
5. To learn basics of partial differential equations and the standard forms of partial differential equations.

Module -I: Matrix algebra

Vector Space, basis, linear dependence and independence (Only Definitions)

Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew- Hermitian; orthogonal matrices; Unitary Matrices; rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; solving system of Homogeneous and Non-Homogeneous linear equations. LU - Decomposition Method

Module- II: Eigen Values and Eigen Vectors

Eigen values , Eigen vectors and their properties; Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); Finding inverse and power of a matrix by Cayley-Hamilton Theorem; Singular Value Decomposition.

Quadratic forms: Nature, rank, index and signature of the Quadratic Form, Linear Transformation and Orthogonal Transformation, Reduction of Quadratic form to canonical forms by Orthogonal Transformation Method.

Module - III: Differential Calculus

Mean value theorems: Rolle's theorem and Lagrange's Mean value theorem with their Geometrical Interpretation and its applications, Cauchy's Mean value Theorem. Taylor's Series. Limits, Continuity, Partial differentiation, partial derivatives of first and second order, Jacobian, Taylor's theorem of two variables (without proof). Maxima and Minima of two variables, Lagrange's method of undetermined Multipliers.

Module –IV: Ordinary Differential Equations

First Order and First Degree ODE: Orthogonal trajectories, Newton's law of cooling, Law of naturalgrowth and decay.

Second and Higher Order ODE with Constant Coefficients: Introduction-Rules for finding complementary function and particular integral. Solution of Homogenous, non-homogeneous differentialequations, Non-Homogeneous terms of the type e^{ax} , sin(ax), cos (ax), polynomials in x, e^{ax} V(x), x V(x),Method of variation of parameters.

Module – V: Partial Differential Equations

Formation of partial differential equations by eliminating arbitrary constants or arbitrary function, solutions of first order linear (Lagrange) equations, solutions of non linear first order equations (four standard types). Equations reducible to linear, Charpit's Method.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R K Jain SRK Iyengar , Advanced engineering mathematics, Narosa publications.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publications.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson,Reprint,2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications,Reprint, 2008.
3. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra,AffiliatedEast–West press, Reprint 2005.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint,2010.

E – RESOURCES:

1. https://www.mathplanet.com/education/algebra-2/matrices/how-to-operate-with-matrices(Systems of linear equations, matrices)
2. http://math.mit.edu/~gs/linearalgebra/ila0601.pdf(Eigen values, Eigen vectors)
3. http://www.math.cmu.edu/~wn0g/noll/2ch6a.pdf(Differential Calculus)
4. https://www.intmath.com/differential-equations/1-solving-des.php(Differential Equations)
5. https://www.math.uni-leipzig.de/~miersemann/pdebook.pdf(Partial differential Equations)

NPTEL:

1. https://www.youtube.com/watch?v=NEpvTe3pFIk&list=PLLy_2iUCG87BLKl8eISe4fHKdE2_j2 B_T&index=5 (Matrices – System of linear Equations)
2. https://www.youtube.com/watch?v=wrSJ5re0TAw (Eigen values and Eigen vectors)
3. https://www.youtube.com/watch?v=yuE86XeGhEA (Quadratic forms)

Course Outcomes:

1. The student will be able to find rank of a matrix and analyze solutions of system of linear equations.
2. The student will be able to find Eigen values and Eigen vectors of a matrix, diagonalization a matrix, verification of Cayley Hamilton theorem and reduce a quadratic form into a canonical form through a linear transformation.
3. The student will be able to verify mean value theorems and maxima and minima of function of two variables.
4. Formulate and solve the problems of first and higher order differential equations
5. Apply knowledge of Partial differential equations in real world problems.

COS	CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	3	3				2			3
CO2	3	2	2	3	2				2			3
CO3	3	2	2	3	2				2			2
CO4	3	2	2	3	3				2			2
CO5	3	2	2	3	3				2			2

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B.Tech. II Semester	
Code: C0201	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING** (Common for ALL)	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: NIL

Course Objectives:

 To introduce the concept of electrical circuits and its components. To introduce the characteristics of various electronic devices. To impart the knowledge of various configurations, characteristics and applications of electrical & electronic components.

MODULE I: DC Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws- Series, parallel, series-parallel, star-to-delta and delta-to-star transformation-analysis ofsimple circuits with dc excitation. Superposition, Thevenin's and Maximum Power Transfer Theorems with DC excitation.

MODULE II: AC Circuits

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC,RLC combinations (series and parallel).

MODULE III: Introduction to Electrical Machines

A: DC Machines: Construction & Principle of Operation of DC Generators – E.M.F Equation. Principle of operation DC Motors – Back E.M.F. - Torque equation – Brake Test - Characteristics.

B: AC Machines: Construction and Principle of operation of Transformer- EMF Equation. Construction and Principle of Operation of 3 Phase Induction Motors - Brake test on 3-Phase Induction Motor – Applications.

MODULE IV: P-N Junction Diode

P-N Junction Diode: Diode equation, Energy Band diagram, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances. Zener diode operation, Zener diode as voltage regulator.

Rectifiers: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, BridgeRectifier.

Filters: Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

MODULE V: BJT and Junction Field Effect Transistor (JFET)

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Symbol, Amplifying Action, Common Emitter, Common Base and Common Collector configurations and Input-Output Characteristics, Comparison of CE, CB and CC configurations

Junction Field Effect Transistor and MOSFET: Construction, Principle of Operation, Symbol, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET.

TEXT BOOKS

1. M.Surya Kalavathi, Ramana Pilla, Ch. Srinivasa Rao, Gulinindala Suresh, "Basic Electrical and Electronics Engineering", S.Chand and Company Limited, New Delhi, 1st Edition, 2017.
2. R.L.Boylestad and Louis Nashlesky, "Electronic Devices & Circuit Theory", Pearson Education, 2007.

REFERENCES

1. V.K. Mehtha and Rohit Mehta, "Principles of Electrical Engineering and Electronics", S.Chand&Co., 2009.
2. Jacob Milliman, Christos C. Halkias, Satyabrata Jit (2011), "Electronic Devices and Circuits", 3rd edition, Tata McGraw Hill, New Delhi.
3. Thomas L. Floyd and R. P. Jain, "Digital Fundamentals", Pearson Education, 2009.
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 2008.
5. Nagrath I.J. and D. P. Kothari, "Basic Electrical Engineering", Tata McGraw Hill, 2001.
6. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Education, New Delhi, 2nd Edition,2005.

E - RESOURCES

1. https://www.electrical4u.com/ohms-law-equation-formula-and-limitation-of-ohms-law/
2. https://www.eeweb.com/passives
3. http://nptel.ac.in/courses/108108076/
4. http://nptel.ac.in/downloads/108105053/

Course Outcomes:

At the end of the course, students will be able to:

1. Apply basic laws in electrical circuit.
2. Analyze the single phase circuits

3. Comprehend the construction and Operation of DC and AC machines
4. Know the practical importance of Diode and its characteristics
5. Recognize the construction and operation of BJT and JFET

COs	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3									3	3	3	3
CO2	3	3	3									3	3	3	3
CO3	3	3	3									3	3	3	3
CO4	3	3	3									3	3	3	3
CO5	3	3	3									3	3	3	3

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: C0501	**Programming for Problem Solving**	**L**	**T**	**P**
Credits: 3	(Common for CE, EEE, ME, ECE, CSE, CSE (Cyber Security), CSE (AI and ML), CSE (DS), CSE (IOT), AI, IT and Mi.E)	**3**	**-**	**-**

Prerequisites: NIL

Course Objectives:
1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn the syntax and semantics of the C programming language.
4. To learn the usage of structured programming approaches in solving problems

MODULE I: Introduction to Programming   [10 Periods]
Compilers, compiling and executing a program.
Representation of Algorithm - Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number Flowchart/Pseudocode withexamples, Program design and structured programming

Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion,The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators

Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops

I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

MODULE II: ARRAYS, STRINGS, STRUCTURES AND POINTERS: [09 PERIODS]
Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings

Structures: Defining structures, initializing structures, unions, Array of structures
Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self referential structures in linked list (no implementation) Enumerationdata type

MODULE III: Preprocessor and File handling in C: [10 Periods]
Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data toexisting files, Writing and reading structures using binary files, Random access using fseek, ftell andrewind functions.

MODULE IV: Function and Dynamic Memory Allocation: [09 Periods]
Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions,passing pointers to

functions, idea of call by reference, Some C standard functions and libraries

Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

MODULE V: Searching and Sorting: **[10 Periods]**
Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sortarray of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexitythrough the example programs.

TEXTBOOKS
1. Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C 7th Edition,Pearson
2. B.A.Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rdEdition)

REFERENCES
1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall ofIndia
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

E–RESOURCES
1. http://oxford university press.ac.in/eBooks/ Programming in C.
2. https://www.journals.elsevier.com/science-of-computer-programming
3. http://www.ejournalofsciences.org
4. http://onlinecourses.nptel.ac.in/iiitk_cs-101
5. http://onlinevideolecture.com/ebooks/?subject=C-Programming

Outcomes:
At the end of the course, students will be able to
1. To write algorithms and to draw flowcharts for solving problems.
2. To convert the algorithms/flowcharts to C programs.
3. To code and test a given logic in the C programming language.
4. To decompose a problem into functions and to develop modular reusable code.
5. To use arrays, pointers, strings and structures to write C programs.
6. Searching and sorting problems.

COS	CO- PO,PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2				2	1	1	3	3	2	2
CO2	3	3	2	2	2				2	1	1	3	3	2	1
CO3	3	3	3	2	2				1			3	3	2	1
CO4	3	2	3	2	2				1		1	2	3	2	1
CO5	3	3	3	2	2				1	1	1	2	3	2	1

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: C0202	Basic Electrical and Electronics Engineering Lab (Common for ALL)	L	T	P
Credits: 1		-	-	2

Prerequisites: Nil

Course Objective:

To get practical knowledge about basic electrical circuits, electronic devices like Diodes, BJT, JFET and also analyse the performance of DC Motors, AC Motors and Transformers.

List of Experiments:

1. Verification of Kirchhoff's Laws.

2. Verification of Maximum Power Transfer Theorem.

3. Determination of Phase Angle for RC series circuit.

4. Brake Test on DC-Shunt Motor. Determination of Performance curves

5. Load Tests on Single Phase Transformer

6. Brake Test on Three Phase Induction Motors. Determination of Performance curves

7. V-I Characteristics of PN junction Diode

8. V-I Characteristics of Zener Diode

9. Half Wave Rectifier and Full Wave rectifier.

10. Input and Output characteristics of BJT with CE configuration

11. Input and Output characteristics of BJT with CB configuration

12. Input and Output Characteristics of JFET.

Course Outcomes:

At the end of the course, students will be able to

1. Analyze electrical circuits by applying basic laws

2. Analyze the performance of DC Motor, three phase Induction motor and transformer

3. Understand V-I Characteristics of various diodes

4. Design Different Rectifier Circuits

5. Differentiate the Transistors and their Operations

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3					3			3			
CO2	3	3	3	3					3			3			
CO3	3	3	3	3					3			3			
CO4	3	3	3	3					3			3			
CO5	3	3	3	3					3			3			

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: C0502	**Programming for Problem Solving Lab** (Common for ALL)	**L**	**T**	**P**
Credits: 1		-	-	2

Prerequisites: NIL

Course Objectives:

1. Understand the various steps in Program development
2. Identify syntax and semantics of C Programming Language
3. Illustrate the usage of structured programming approach in solving problems.
4. Develop programs that make use of arrays, strings, pointers and structures in C language
5. Analyse different file operations

Software Requirements: C

List of Programs:

1. a. Practice various Internal and External DOS Commands.
   b. Write sample examples of C programs to implement basic operations.
2. a. Write a C program to find smallest and largest of given three numbers.
   b. Write a C program to find the roots of a quadratic equation.
   c. Write a C program to check whether given character is alphabet, digit or special symbol
3. a. Write a C program to find the sum of individual digits of a positive integer.
   b. Write a C program to generate the first 'n' terms of the sequence.
      [A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.]

4. a. Write a C program to find whether the given number is palindrome, perfect, Armstrong or strong.
   b. Write a C program to generate all the prime numbers between n1 and n2, where n1 and n2 are values supplied by the user.
5. Write C programs that use both recursive and non-recursive functions
   a. To find the factorial of a given integer.
   b. To find the GCD (greatest common divisor) of two given integers.
6. a. Write a C program to find both the largest and smallest number in a list of integers.
   b. Write a C program that uses non-recursive function to search for a Key value in a given list of integers using linear search.

c. Write a C program that uses recursive and non -function to search for a Key value in a given sorted list of integers using Binary search.

7. a. Write a C program that implements the Bubble sort method to sort a given array of integers in ascending order.
   b. Write a C program that implements the Selection sort method to sort a given list of names in ascending order.

8. Write a C program to perform the following:

   a. Addition of Two Matrices
   b. Multiplication of Two Matrices.

9. Write a C program that uses functions to perform the following operations:
   a. To insert a sub-string into given main string from a given position.
   b. To delete n characters from a given position in a given string.
   c. To find substring in a given string

10. a. Write a C program to determine if the given string is a palindrome or not
    b. Write a C program to count the lines, words and characters in a given text.

11. a. Write a C program to swap two numbers, which implement call by value and call by reference.
    b. Write a C program to display the below student details using structures

Roll Number	Name	Gender	Branch	Attendance percentage
501	John	male	CSE	77.3
502	Alice	male	ECE	80.5
503	Sam	female	IT	90.7

    c. Write a C program to find grade of a student using structures.

12. a. Write a C program which copies one file to another
    b. Write a C program to find sum of two numbers using command line arguments

13. a. Develop a mini project which implement the Library Management System
    b. Develop a mini project which implements the Student Record System

TEXT BOOKS:

    a. Computer Fundamentals and Programming in C, P. Dey, M Ghosh, Second edition, Oxford University Press
    b. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Eighth Edition, Pearson Education.
    c. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCES:

    a. C Programming & Data Structures, B.A. Forouzan and R.F. Gilberg, Third Edition, Cengage Learning
    b. C for Engineers and Scientists, H. Cheng, Mc. Graw-Hill International Edition
    c. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

Course Outcomes:

At the end of the course, students will be able to

    1. Analyse concepts in problem solving and write diversified solutions for a given problem.
    2. Identify situations where computational methods and computers would be useful.
    3. Understand the programming tasks using techniques learned and write pseudo-code.
    4. Compare the program on a computer, edit, compile, debug, correct, recompile and execute it.
    5. Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**P09**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3										2	2	
CO2	3	3	3										2	2	
CO3	2	2	2										2	2	
CO4															
CO5															

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERINGCOLLEGE (Autonomous)	B.Tech. I Semester		
Code: C0H02	English Language and communication skills Lab (Common for CE,EEE,ME,ECE,CSE,CSE(AIML) CSE(DS), CSE (CS), CSE(IOT),IT and Min.E)	L	T	P
Credits: 1		-	-	2

The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Course Objectives:

The course aims to develop students' intelligibility in their pronunciation of English - speech sounds, word accent, intonation and rhythm. It also helps to improve the fluency in spoken English and make them aware of nuances of major skills, namely, listening and speaking skills. It also trains students to understand nuances of both verbal and non-verbal communication during all activities. The course enables the learners to develop their confidence levels so as to participate in discussions, debates and public speaking.

Listening Skills:

Objectives:

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

*Students should be given practice in listening to the sounds of the language to be able to recognize them, awareness regarding stress and recognize and use the right intonation in sentences.

   • Listening for general content
   • Listening to fill up information
   • Intensive listening
   • Listening for specific information

Speaking Skills:

Objectives:

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

• Oral practice
• Describing objects/situations/people
• Just A Minute (JAM) Sessions.

Syllabus: English Language Communication Skills Lab shall have two parts:

a. Computer Assisted Language Learning (CALL) Lab
b. Interactive Communication Skills (ICS) Lab
The following course content is prescribed for the English Language Communication Skills Lab

Module - I:

CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants

ICS Lab **:** Ice-Breaking activity and JAM session; Listening: listening for sounds in context, for ideas; Speaking: ideation and translation ofideas into sentences.

Module - II:

CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker –Weak Forms and Strong Forms - Consonant Clusters.

ICS Lab **:** Situational Dialogues – Role-Play- Expressions in Various Situations –

Self-introduction and Introducing others – Greetings – Apologies – Requests – Social and Professional Etiquette - Telephone Etiquette; Listening: listening for specific purposes, for details; Speaking: speaking in the above situations with clarity, connectivity, maintaining voice characters.

Module - III:

CALL Lab: Word accent and Listening Comprehension-reading(aloud) meaningfully.

ICS Lab **:** Descriptions- Narrations- Giving Directions and guidelines; Listening: listening for intelligible English; Speaking: formaland informal conversations, register.

Module - IV:

CALL Lab: Intonation and Common errors in Pronunciation- reading aloud(evaluating through recording).

ICS Lab: Extempore- Public Speaking, Oral Presentation Skills; Listening: note taking and listening for speaker's tone/attitude; Speaking: organizing, connecting ideas and sentences, short forms in spoken English, errors in spoken English

Module - V:

CALL Lab: Neutralization of Mother Tongue Influence and Conversation Practice

ICS Lab **:** Information Transfer, Debate

Minimum Requirement of infra structural facilities for EL Lab:

1. Computer Assisted Language Learning (CALL) Lab:
The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

a) P – IV Processor   b) Speed – 2.8 GHZ   c) RAM – 512 MB Minimum

d) Hard Disk – 80 GB   e) Headphones of High quality

2. **Interactive Communication Skills (ICS) Lab:** The Interactive Communication Skills Lab:
A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.
Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

Prescribed Lab Manual:

Rani, Sudha. *English Language Communication Skills Laboratory*. 5th edition, Pearson Publication, 2014.

Reference Books:

1. Gairns, Ruth and Redman, Stuart. *Oxford Word Skills: Learn and Practice English Vocabulary.*
   2nd edition, Oxford University Press, 2008.

2. Hughes, John and Mallett, Andrew. *Successful Presentations DVD and Student's Book Pack*.Oxford University Press, 2013.

3. Hancock, Mark. *English Pronunciation in Use* (Intermediate). 2nd edition, Cambridge UniversityPress, 2009.

4. Karia, Akash. *Public Speaking Mastery: Speak Like a Winner*. Kindle edition, 2013.

5. Lucas, Stephen. *The Art of Public Speaking.* 11th edition, Tata McGraw Hill, 2011.

Websites:

1. http://www.mindtools.com/CommSkll/ActiveListening.htm
2. http://www.slideshare.net/alisonkis/dialogue-and-roleplay-activity
3. http://www.hse.ru/pubs/lib/data/access/ram/ticket/2/14309868938d576a532b71360b7354268380727a22/An%20article%20for%20Monika%20(2010).pdf

Course Outcomes:

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

1. Understand the nuances of language through audio- visual experience and group activities.
2. Neutralize the accent for intelligibility
3. realize the importance of listening skills and speaking skills and their application in real life situations.
4. Recognize significance of non-verbal communication and develop confidence to face audience and shed inhibitions.
5. Speak with clarity and confidence; thereby enhance employability skills of the students.

COS	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1				1		1	2	2		1			
CO2										1		1			
CO3						1		1	2		2				
CO4							1	1	2		2				
CO5									2		2				

CO- PO,PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code:C0302	ENGINEERING WORKSHOP (Common for CE, ME and Min.E)	L	T	P
Credits: 1		-	-	2

COURSE OBJECTIVES:

To understand the usage of hand tools, acquire the skills in model / pattern making and familiarize with various work materials and tools.

I. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry 2.Fitting 3. Tin-Smithy
4. House-wiring 5.Foundry 6.Arc welding

II. TRADES FOR DEMONSTRATION & EXPOSURE

1. Machine shop
2. Plumbing
3. Wood working lathe
4. Identification of Electronic Components
5. Black smithy
6. Hand Lay up method
7. Computer Peripherals

COURSE OUTCOMES

At the end of the course, students will be able to

1. Knowledge of carpentry process and methods used in the design and fabrication, installation, maintenance and repair of structures and fixtures (e.g., furniture, cabinets) to accomplish work assignments.
2. Assembling of part and removing metals to secure the necessary joint by using fitting and welding.
3. Understand the hardware components of house wiring.
4. Understand the manufacturing process using machine shop.
5. Analyze the different types of computer Peripherals

	CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)													PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2	2	1		3			3		2	
CO2	3				2	2	1		3			3		2	
CO3	3				2	2	1		3			3		2	
CO4	3				2	2	1		3			3		2	
CO5	3				2	2	1		3			3		2	

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B.Tech. II Semester	
Code:C0B06	Vector Calculus and Numerical Techniques (Common For CE,ME&MINING)	L	T	P
Credits: 4		3	1	-

Pre- requisite: Basics of vectors, Differentiation and Integration.

Course Objectives: To learn

1. The physical quantities involved in engineering field related to vector valued functions.
2. The basic properties of vector valued functions and their applications to line, surface and volume integrals.
3. The various numerical techniques which are indispensable tools to solve many algebraic and transcendental equations.
4. Numerical methods of solving the ordinary differential equations.
5. Evaluation of PDE and their applications by using numerical techniques.

MODULE – I: Vector Differentiation

Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives,. Scalar potential functions. Solenoid and Irrotational vectors. Vector Identities.

MODULE – II: Vector Integration

Line, Surface and Volume Integrals. Green Theorem, Gauss Divergence Theorem and Stokes Theorem (without proofs) and their applications.

MODULE III: : Algebraic and Transcendental equations and Interpolation

(A) Solution of Algebraic and Transcendental Equations: Introduction-Errors, types of errors. Bisection Method, Method of False Position. The Iteration Method – Newton-Raphson Method

(B) Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences-Forward Differences-Backward differences – Symbolic relations and separation of symbols, Differences of a polynomial-Newton's formulae for interpolation, Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange's Interpolation formula.

MODULE – IV: Numerical solution of Ordinary Differential Equations and Numerical Integration

Numerical solution of Ordinary Differential Equations Introduction-Solution by Taylor's series method - Picard's Method of successive Approximations, Euler's Method, Modified Euler's Method – Runge-Kutta Methods.

Numerical Integration: Trapezoidal Rule, Simpson's 1/3rd Rule, Simpson's 3/8 Rule.

MODULE – V: Numerical solution of PDE

Classification of second order equations , Finite difference approximations to derivatives ,- standard 5- point formula ,diagonal 5-point formula , solution of Laplace equation, Solution of Poisson's equation. Solution of one-dimensional heat, wave equations (by Crank-Nicolson explicit/implicit formula only).

Text Books:

1) B.S. Grewal, **Higher Engineering Mathematics**, Khanna Publishers, 36th Edition, 2010.
2) R K Jain S R KIyengar, **Advanced engineering mathematics**, Narosa publications.
3) Erwin Kreyszig, **Advanced Engineering Mathematics**, Wiley publications.
4) M. K Jain, S R K Iyengar, R.K Jain, **Numerical Methods for Scientific and Engineering Computation**, New age Internationalpublishers.
5) S.S.Sastry, **Introductory Methods of Numerical Analysis**,5th Edition,PHI Learning Private Limited

Reference Books:

1. Kanti B. Datta**"Mathematical Methods of Science and Engineering",** Cengage Learning.
2. Alan Jeffrey **"Mathematics for Engineers and Scientists"**, Chapman & Hall/ CRC, 6th Edition2013
3. Michael Greenberg **"Advanced Engineering Mathematics"**, Pearson Education Second Edition.
4. G.B. Thomas and R.L. Finney, **Calculus and Analytic geometry**, 9th Edition, Pearson,Reprint, 2002

E Resources:

a) **Concerned Website links**
1. http://www.mecmath.net/calc3book.pdf(VectorCalculus)
2. http://www.simumath.com/library/book.html?code=Alg_Equations_Examples (Algebraic and transcendental equation text book by YURG BERENGARD)
3. http://jupiter.math.nctu.edu.tw/~smchang/9602/NA_lecture_note.pdf (Interpolation)
4. http://nptel.ac.in/courses/104101002/downloads/lecturenotes/module1/chapter6.pdf (Numerical Differentiation and Integration)
5. http://www.sam.math.ethz.ch/~hiptmair/tmp/NPDE10.pdf(Numerical Solution of Partial Differential Equations)

b) **Concerned Journals/Magazines links**
1. https://www.jstor.org/stable/27953736?seq=1#page_scan_tab_contents(Algebraic and transcendental equation by William L. Schaaf)
2. http://www.ijcsi.org/papers/IJCSI-9-6-2-413-419.pdf(Algebraicandtranscendental equation by Md.Golam Moazzam)
3. http://www.iosrjournals.org/iosr-jm/papers/Vol6-issue6/J0665862.pdf (Interpolation)

c) **NPTEL Videos**

1. http://nptel.ac.in/courses/122102009 (Algebraic and transcendental equation)
2. http://nptel.ac.in/courses/112104035/14 (Mathematical methods in engineering and science by Prof.Bhaskar Dasgupta)
3. http://nptel.ac.in/courses/111107063 (Numerical solution of Ordinary Differential Equations)
4. http://nptel.ac.in/courses/111105038 (Numerical Solution of Partial Differential Equations)

Course Outcomes:

After completion of this course, students will be able to:

1. Apply the concept of Gradient, Divergence and Curl of a vector valued functions and scalar valued functions in engineering and physical problems.
2. Apply vector integral theorems in engineering and physical problems.
3. Apply numerical methods to solve some algebraic and transcendental equations to the desired level of accuracy and by applying interpolation concept to evaluate missed data in data analysis.
4. Apply differential equations in engineering-oriented problems and to observe patterns by using numerical techniques.
5. To find out the Numerical solution of partial differential equations.

	CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2								1	3	3	2
CO2	3	3	2	3									3	3	2
CO3	3	3	3	3								1	3	3	3
CO4	3	3	3	3									3	3	3
CO5	3	3	3	3									3	3	3

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: C0303	ENGINEERING MECHANICS (Common for CE, ME and Min.E)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

COURSE OBJECTIVES:

The objective of this subject is to provide the basic concepts and effect of system forces on rigid bodies, Geometrical Properties of Planes and Solids, problem solving in kinematics and kinetics using different methods and to analyze the types of friction for moving bodies and problems related to friction.

MODULE I: Introduction to Mechanics & System of Forces

Introduction: Basic Concepts, Laws of Motion, Force - types, characteristics - Principle of transmissibility - Types of Forces - Concurrent and non-concurrent Forces - Composition of force – Resultant - Triangle, Polygon and Parallelogram Law of Forces - Moment of Force and its Application -Varignon's theorem, Couples - Free Body Diagrams, Types of Supports and their reactions, Internal and External Forces - Types of Equilibrium, Equations of Equilibrium, Conditions of Equilibrium - Lami's Theorem.

MODULE II: Friction, Centroid and Center of Gravity

Friction: Types of friction, Limiting friction, Laws of friction, static and dynamic friction, application of laws of friction. Motion of bodies - wedge, screw, screw jack.

Centroid and Center of Gravity: Introduction, Centroids of Lines and Areas - simple figures - Centroid of composite figures. Pappus theorem - Centre of gravity of simple solids, composite solids - Centroids of volumes.

MODULE III: Moment of Inertia

A: Area Moment of Inertia: Definition - Moment of Inertia of plane areas, Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures.

B: Mass Moment of Inertia: Introduction-moment of inertia of masses - Radius of gyration- Transfer formula for mass moment of inertia- by integration - Moment of Inertia of composite bodies.

MODULE IV: Kinematics& Kinetic

Kinematics: Rectilinear motion - Motion of Rigid Body under uniform and variable accelerations -motion under gravity- curvilinear motion – Projectiles - rotary motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation -D'Alemberts Principle - Connected bodies- Kinetics of rotating bodies.

MODULE V: Work, Power, Energy & Mechanical Vibrations

Work, Power and Energy: Introduction, work-energy equation - motion of connected bodies - work done by a spring - general plane motion. Mechanical Vibrations: Definitions, concepts - simple harmonic motion - free vibrations - Simple and compound pendulums.

TEXT BOOKS

1. S. Timoshenko, D.H. Young, J.V. Rao and Sukumar Pati**, "EngineeringMechanics"**, Tata McGraw-Hill Education, 5th Edition, 2013.
2. K.Vijaya Kumar Reddy, J. Suresh Kumar**, "Engineering Mechanics"**, B SPublications, 3rd Edition, 2013

REFERENCES

1. Beer, F.P and Johnston Jr. E.R. "**Vector Mechanics for Engineers**", Tata McGraw-Hill Education 10th Edition (India) Pvt Ltd.. 2013.
2. Fedinand. L. Singer, **"Engineering Mechanics"**, Harper & Row Publishers, 3rdEdition, 1975.
3. R.S. Khurmi, "**A Text Book of Engineering Mechanics**", S.Chand Publications, 21st Edition, 2007.
4. K L Kumar, "**Engineering Mechanics"**, Tata McGraw Hill Education, 4th Edition, 2011.
5. D.S.Kumar Patil, "**Engineering Mechanics"**, SK Kataria & Sons Publishers, 2ndEdition, 2009.

E - RESOURCES

1. http://www.mathalino.com/reviewer/engineering-mechanics/equilibrium-force-system
2. http://nptel.ac.in/courses/112103109/
3. http://ascelibrary.org/journal/jenmdt
4. https://tll.mit.edu/sites/default/files/SUTDVideoThumb/freebodydiagrams.pdf
5. http://nptel.ac.in/courses/112106180/

COURSE OUTCOMES

At the end of the course students will be able to:

1. Determine the resultant of a system of forces and draw free body diagrams and can frame appropriate equilibrium equations from the free bodydiagram.
2. Understand and solve the fundamental static problems and able to find centroid and centre of gravity.
3. Determine area and mass moment of inertia for various sections.

4. Apply fundamental concepts of kinetics and kinematics of particles to the analysis of simple practical problems.
5. Understand and solve fundamental work, power and energy related problems and know the concepts of mechanical vibrations.

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3								3	2		
CO2	3	3	1	3								3	2		
CO3	3	3	1	3								3	2		
CO4	3	3	1	3								3	2		
CO5	3	3	1	3								3	2		

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B.Tech II Semester	
Code: C0B17	**Engineering Chemistry** (Common for CSE, IT, ECE, EEE, CE, ME and Min.E)	L	T	P
Credits: 4		3	1	-

Course objectives:

The purpose of this course is to emphasize the relevance of fundamentals of chemical sciences in the field of engineering and to provide basic knowledge on atomic- molecular orbital's, electrochemistry, batteries, corrosion and the role of water as an engineering material in domestic-industrial use. They will also impart the knowledge of stereochemistry, understanding the chemical reaction path way mechanisms and synthesis of drugs. Listing out various types offuels and understanding the concept of calorific value and combustion.

Module I: Water and its treatment

Introduction to water, hardness of water, causes of hardness, expression of hardness, units and types of hardness-Numerical Problems. Alkalinity of water, specifications of potable water (BIS); Estimation of temporary & permanent hardness of water by EDTA method. Boiler troubles - Scale & Sludge, Priming and foaming, caustic embrittlement and boiler corrosion; Treatment of boiler feed water - Internal treatment (colloidal, phosphate, carbonate and calgon conditioning). External treatment - Lime Soda process (cold & hot) and ion exchange process, Numerical Problems. Disinfection of water by chlorination and ozonization. Desalination by Reverse osmosis and its significance.

Module II: Molecular structure and Theories of Bonding:

Introduction to Molecular orbital Theory. Linear Combination of Atomic Orbital's (LCAO), significance of bonding and anti-bonding molecular orbital, Conditions for the formation of molecular orbital's. Molecular orbital energy level diagrams of diatomic molecules -, N_2 ,O_2 and F_2. Introduction to coordination compounds-ligand-coordination number (CN) - spectrochemical series. Salient features of crystal field theory, Crystal field splitting of transition metal complexes in octahedral ($[CoF_6]^{3-}$ and $[Co(CN)_6]^{3-}$) and tetrahedral ($[NiCl_4]^{2-}$ and $[Ni(CO)_4]$) fields - magnetic properties of complexes. Bandstructure of solids and effect of doping on conductance.

Module III: Electrochemistry and Corrosion

A. Electrochemistry:
Introduction to Electrochemistry-Conductance (Specific and Equivalent) and units. Types of cells- electrolytic & electrochemical cells (Galvanic Cells)-Electrode potential- cell potential (EMF).Electrochemical series and its applications, Nernst equation its applications and numerical problems. Reference electrodes - Calomel Electrode and Glass electrode-determination of pH using glass electrode. Batteries: Primary (dry cells) and secondary (Lead-Acid cell, Ni-Cd cell) - applications of batteries. Fuel cells: Hydrogen - Oxygen fuel cell and its applications.

B. Corrosion:

Causes and effects of corrosion: Theories of corrosion - Chemical & Electrochemical corrosion, Pilling- Bedworth rule, Types of corrosion: Galvanic and Water-line corrosion. Factors affecting rate of corrosion-Nature of metal and Nature of Environment, Corrosion control methods - Cathodic protection (Sacrificial anodic and impressed current cathodic methods). Surface coatings: Methods of metallic

coatings - hot dipping (Galvanization), Electroplating (Copper) and Electroless plating (Nickel).

Module IV: Stereochemistry, Reaction mechanism & synthesis of drug molecules and NMR spectroscopy:

Introduction to Isomers - classification of isomers - structural (chain, positional & functional) and stereoisomerism-geometrical (cis-trans & E-Z system) - characteristics of geometrical isomerism, optical isomerism (chirality - optical activity, specific rotation, enantiomers and diastereomers) of tartaric acid and lactic acid. Conformational isomerism of n-Butane. Introduction to bond cleavage (homo & hetero cleavage) - reaction intermediates and their stability. Types of organic reactions - Mechanism of substitution (SN^1 & SN^2) and (E1&E2) reactions with suitable example. Ring opening (Beckmann rearrangement), oxidation and reduction (Cannizaro reaction), cyclization (Components of Diels-Alder reaction-Mechanism of Diels-Alder reaction with suitable example) reactions. Synthesis of Paracetamol,Aspirin and their applications.

Introduction to Spectroscopy, Basic concepts of nuclear magnetic resonance spectroscopy, chemical shiftand spin-spin splitting.

Module-V Fuels and Combustion

Fuels: Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking – types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG. **Combustion:** Definition, Calorific value of fuel – HCV, LCV; Calculation of air quantity required for combustion of a fuel. Determination of calorific value by Junkers gas calorimeter-Numerical problems on combustion.

Text Books:

1. P.C.Jain and Monica Jain, "**A Text Book of Engineering Chemistry**", DhanpatRai Publications, New Delhi, 16th Edition 2014.
2. S.S. Dara and S.S. Umare, "**A Text Book of Engineering Chemistry**", S Chand Publications,New Delhi, 12th Edition 2010.
3. A.Jaya Shree, "Text book of Engineering Chemistry", Wiley, New Delhi, 2018.

Reference Books:

1. B.Rama Devi, Ch.VenkataRamana Reddy and PrasanthaRath, **"Text Book of Engineering chemistry"**, Cengage Learning India Pvt.Ltd,2016.
2. M.G. Fontana and N. D. Greene, "**Corrosion Engineering**", McGraw Hill Publications, NewYork, 3rd Edition, 1996.
3. K. P. C. Volhardt and N. E. Schore, **"Organic Chemistry: Structure and**

Function", 5thEdition, 2006.

e-Resources:

a) Concerned Website links:

1) https://books.google.co.in/books?isbn=0070669325 (Engineering chemistry by Sivasankar).
2) https://www.youtube.com/watch?v=yQUD2vzfgh8 (Hot dipping Galvanization).
3)https://archive.org/stream/VollhardtOrganicChemistryStructureFunction6th/Vollhardt_Organic_Ch emistry
_Structure_Function_6th_djvu.txt.

b) Concerned Journals/Magazines links:

1) http://americanhistory.si.edu/fuelcells/sources.htm (Fuel Cell Information Sources)
2) https://www.abctlc.com/downloads/courses/WaterChemistry.pdf (Water Chemistry)

c) NPTEL Videos:

1) nptel.ac.in/courses/113108051/ (corrosion & electrochemistry web course)
2) https://www.youtube.com/watch?v=V7-8EOfZKeE (Stereochemistry)

Course Outcomes:

After completion of the course students will be able to:

1. Understand water treatment, specifically hardness of water and purification of water by various methods.
2. Analyze microscopic chemistry in terms of atomic and molecular orbital's splitting and band theory related to conductivity.
3. Acquire knowledge on electrochemical cells, fuel cells, batteries and their applications.
4. Acquire basic knowledge on the concepts of stereochemistry, reaction mechanisms and interpretation of NMR in organic molecules.
5. Acquire the knowledge of various fuels and identify a better fuel source of less pollution.

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	2										
CO2	2	1		2	1										
CO3	3	3	2	2	1		2								
CO4	3	1	1	1	2	1	3								
CO5	3	3	3	1			3								

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code:C0B12	**Engineering Physics** (Common For CE, ME&MINING)	**L**	**T**	**P**
Credits: 4		**3**	**1**	**-**

Prerequisites: Fundamentals of Physics

Course Objectives:

- The main objective of this course is to provide the basic physics principles, would help engineers to understand the tools and techniques used in the industry and provide the necessary foundations for inculcating innovative approaches.
- This would create awareness about the vital role played by science and engineering in the development of new technologies.

Module – I: Waves and Oscillations

Simple harmonic Oscillator; damped harmonic oscillator; types of damping – heavy, critical and light damping; energy decay in a damped harmonic oscillator; relaxation time, quality factor; Forced harmonic Oscillator; electrical and mechanical analogy for a simple oscillator.

Module – II

Acoustics: Introduction, Reverberation and Reverberation time; Basic requirements of acoustically good hall; Absorption coefficient, Jaeger's method for derivation of Sabine's formula; factors affecting the architectural acoustics and their remedies.

Ultrasonics: Introduction, Production of Ultrasonic Waves - Piezo Electric Effect, Inverse piezo electric effect, Piezo-Electric crystal Method, Magnetostriction effect, Magnetostriction Method; Detection ofUltrasonic waves - Piezo Electric detector, Kundt's tube method, Sensitive Flame method and ThermalDetection Method; Applications of Ultrasonics - Medical, SONAR, Ultrasonic drilling and welding, **Module – III: LASERs and Optical Fibers**

LASER: Introduction, Characteristics of LASER; Absorption, spontaneous and Stimulated emission; Einstein's coefficients Derivation; population inversion; pumping mechanisms; Basic components of a laser system; three and four level laser systems; Ruby LASER; He-Ne LASER; Semiconductor diode LASER (Homo junction); Applications of LASER - Computers,Medical, Military.

Optical Fibers: Introduction to Optical fibers, total internal reflection; Acceptance angle, and acceptance cone; numerical aperture; types of optical fibers; Losses in optical fibers - absorption losses, scattering losses and bending losses; Applications of optical fibers - Communications, Level Sensor, LASER angioplasty.

Module – IV

Non-destructive Testing: Introduction; Objectives of Non-destructive testing; Types of defects – Cracking, Spalling, Staining, Construction and Design defects, Honey combing, Dusting, Blistering, Rain damage; Methods of Non-destructive testing – Liquid penetrant testing, Magnetic particle testing, Ultrasonic inspection method and Radiography testing.

Module – V

Dielectric Properties: Electric dipole, Dipole moment, Dielectric constant, Polarizability, Electric Susceptibility, Displacement Vector; Determination of dielectric constant by resonance method; Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities - Electronic and ionic; Internal field (qualitative treatment); Clausius-mossotti equation; Applications of Dielectric materials.

Nanomaterials: Introduction to nanomaterials, Types of nano materials; factors affecting the properties of nano materials - surface area to volume ratio and Quantum confinement effect; Properties of nano materials; Synthesis of nanomaterials - Sol-gel and Chemical vapour deposition method; Applications ofNanomaterials.

Text Books:

1. M N Avadhanulu, P G Kshirsagar, "ATextbookofEngineering Physics", Revised Edition2014.
2. KVijaya Kumar, S Chandralingam, "ModernEngineering Physics'' Volume I & II, S. Chand, 1st Edition,2017.
3. BKPandeyand S. Chaturvedi, "Engineering Physics" Cengage Learning India Revised Edition, 2014.

References:

1. P K Palanisamy, "**Engineering Physics''**, 4th Edition, SciTech Publications, 2014.
2. G Prasad and Bhimashankaram, "**Engineering Physics''**, B S Publications, 3rd Edition, 2008.
3. M.K.Verma, "Introductionto Mechanics", UniversitiesPress.
4. Ajoy Ghatak, "Optics", McGraw-Hill Education, 2012

e-Resources

1. http://www.gistrayagada.ac.in/gist_diploma/PHYSICS-StudyMaterial.pdf
2. http://www.faadooengineers.com/threads/3300-Applied-Physics-Ebooks-pdf-f ree- download?s=1b6cb6b1de4e7152298bd9d60156cd11

Journals:

1. http://aip.scitation.org/journal/jap
2. http://www.springer.com/physics/journal/340

NPTEL Videos:

1. http://nptel.ac.in/courses/115106061/13

2. https://nptel.ac.in/courses/115/106/115106119/

CourseOutcomes:

At the end of the course, student will be able to

1. Distinguish free, damped and forced vibrations.
2. Using the knowledge of acoustics in designing acoustically important buildings and ultrasonicsfor designing materials.

3. Understand the concepts and applications of LASER and Optical fibers.
4. Apply the knowledge of Ultrasonic to understand non-destructive testing.
5. Understand the importance of dielectric and nanomaterials and their properties.

CO- PO,PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	Programme Outcomes(POs)												PSOS		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										3	2	
CO2	2	2	1										3		
CO3	3	2	2										3	2	
CO4	3	1	2										3		
CO5	3	2	2										3		

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B.Tech. II Semester	
Code: C0301	ENGINEERING GRAPHICS (Common for CE, ME and Min.E)	L	T	P
Credits: 3		2	-	2

Prerequisites: Nil

Course Objectives: To develop in students, graphic skills for communication of concepts and ideas of engineering products.

MODULE I: Introduction to Engineering Drawing, Scales and Curves Introduction to Engineering Drawing: Principles of Engineering Graphics andtheir significance. Lettering and dimensioning. Geometrical Constructions: Regular polygons only.

Scales: Plane Scale, Comparative Scale, Diagonal Scale, Vernier Scale

Curves: Conic Sections: Ellipse, parabola, Hyperbola- General Method only, Cycloidal Curves and Involutes.

MODULE II: Projection of Points, Lines and Planes

Projection of Points: Principles of Orthographic Projections – Conventions – First and Third Angle projections. Projection of points including all four quadrants.

Projection of Lines: Projection of Lines - parallel, perpendicular, inclined to one reference plane and inclined to both reference planes. True length and true angle of a line.

Projection of Planes: Projection of Planes - Axis inclined to one reference plane, Axis inclined to both the planes

MODULE III: Projection of Solids, Section of Solids and Development of Surfaces

A. Projection of Solids: Projections of regular solids like cube, prism, pyramid, cylinder and cone by rotating object method. Axis inclined to one reference plane.

B. Section of Solids: Sectioning of single solid with the cutting plane inclined to one plane and perpendicular to the other - true shape of section.
C. Development of Surfaces: Development of lateral surfaces of simple Solids.

MODULE IV: Isometric Projections and Transformation of Projections

Isometric Projections: Principles of Isometric Projection – Isometric Views– Conventions –Plane Figures, Simple Solids.

Transformation of Projections: Conversion of Isometric Views to Orthographic Views and vice versa– simple objects.

MODULE V: Introduction to Computer Aided Drafting

CAD workstation, Advantages of CAD, CAD Software, AutoCAD – Opening and Creating Drawings-Exploring the AutoCAD interface-Zooming and Panning, AutoCAD Commands and Toolbars-Basic Drawing and Editing Commands.

TEXT BOOKS

1. K.L.Narayana, S.Bheemanjaneyulu "**Engineering Drawing with Auto CAD-2016**" NewAge International Publishers, 1st Edition, 2018.
2. N.D. Bhat, "**Engineering Drawing**", Charotar Publishing House, 53rd Edition, 2014.

REFERENCES

1   K.L.Narayana, P.Kannaiah, "**Engineering Drawing**", SciTech Publishers. 2nd Edition, 2017

2   K.Venugopal,"**Engineering Drawing**",NewAge International Publishers, 3rd Edition, 2014.

3   K. V. Natarajan, "**A text book of Engineering Graphics**", Dhanalakshmi Publishers, 2015.

4   M.S. Kumar, "**Engineering Graphics**", D.D. Publications, 2011.

5   Trymbaka Murthy, "**Computer Aided Engineering Drawing**", I.K. internationalPublishing House, 3rd Edition, 2011.

E - RESOURCES

1   https://www.slideshare.net/search/slideshow?searchfrom=header&q=engineering+drawing

2   https://www.wiziq.com/tutorials/engineering-drawing

3   http://freevideolectures.com/Course/3420/Engineering-Drawing

4   http://www.worldcat.org/title/journal-of-engineering-graphics/oclc/1781711

5   http://road.issn.org/issn/2344-4681-journal-of-industrial-design-and-engineering-graphics

6   http://nptel.ac.in/courses/112103019/

Course Outcomes:

At the end of the course students will be able to

1. Understand the basics of drawings and importance of curves.
2. Draw the projection of lines and planes.
3. Draw the projection of solids and section of solids.
4. Produce development of surface and isometric projections.
5. Convert orthographic views to isometric views and vice-versa.

CO- PO,PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
	Programme Outcomes(POs)												PSOs		
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1		1					3		3	2		
CO2	3		1		1					3		3	2		
CO3	3		1		1					3		3	2		
CO4	3		1		1					3		3	2		
CO5	3		1							1		1			

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: C0527	**Basic Python Programming Lab** (Common for CE, EEE, ME, ECE, MiE)	**L**	**T**	**P**
Credits: 2		-	1	2

Prerequisites: NIL

Course Objectives: To be able to introduce core programming basics and program design with functions using Python programming language, understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.

Software Requirements:

Python List of Programs:

1. a) Write a program to demonstrate different number data types in Python.
   b) Write a program to perform different Arithmetic Operations on numbers in Python.

2. a) Write a program to create, concatenate and print a string and accessing sub-string from a given string.
   b) Write a python script to print the current date in the following format "Sun May 29 02:26:23IST 2017"

3. Write a program to create, append, and remove lists in python.
4. Write a program to demonstrate working with tuples in python.
5. Write a program to demonstrate working with dictionaries in python.
6. a) Write a python program to find largest of three numbers.
   b) Write a Python program to convert temperatures to and from Celsius, Fahrenheit.   [
   Formula : c/5 = f-32/9]

7. a) Write a Python script that prints prime numbers less than 20.
   b) Write a python program to find factorial of a number using Recursion.

8. a) Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
   b) Write a python program to define a module and import a specific function in that module to another program.

9. a) Write a program that defines and print a matrix.
   b) Write a program to perform addition of two square matrices.
   c) Write a program to perform multiplication of two square matrices.
10. a) Write a function dups to find all duplicates in the list.
    b) Write a function unique to find all the unique elements of a list.

11. a) Write a program to print each line of a file in reverse order.

b) Write a program to compute the number of characters, words and lines in a file.

12. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.

TEXT BOOKS:

1. Vamsi Kurama, "Python Programming: A Modern Approach", Pearson Publications.
2. Mark Lutz," Learning Python", Orielly Publishers

REFERENCES:

1. Allen Downey, "Think Python", Green Tea Press

2. W. Chun, "Core Python Programming", Pearson.
3. Kenneth A. Lambert, "Introduction to Python", Cengage

Course Outcomes:

At the end of the course, students will be able to

1. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions..
2. Demonstrate proficiency in handling modules, strings and file systems
3. Create, run and manipulate Python Programs using regular expressions and multithreaded programming environments
4. Interpret the concepts of object-oriented programming in Python.
5. Implement exemplary GUI applications related to Web Programming in Python

COs	\multicolumn{12}{c}{Programme Outcomes (POs)}											\multicolumn{3}{c}{PSOs}		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		3		3				1		1	2	2	1	
CO2			2		3							1	1		
CO3			2		2							2			2
CO4	1	2	3	2	3		1		3		1	2			3
CO5					3						1	2			2

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: C0304	ENGINEERING MECHANICS LAB (Common for CE, ME and Min.E)	**L**	**T**	**P**
Credits: 1		-	-	2

COURSE OBJECTIVES:

The objective of this subject is to provide the basic concept of force, moment of inertia, reaction and moments by practically.

List of Experiments

1. Verify the triangle law and polygon law of forces.
2. To find the equilibrium of coplanar concurrent force system-forces in the jib crane.
3. To determine the support reaction for a beam.
4. To determine the moment of inertia of a flywheel.
5. To verify the law of moments by disc apparatus.
6. To determine the coefficient of friction.
7. To verify the equilibrium of Non Concurrent forces.
8. To verify the equilibrium of forces using force table.
9. To determine the efficiency of a simple screw jack apparatus.
10. To estimate the value of acceleration due to gravity by using compound pendulum.
11. To determine the efficiency of Worm and Worm Wheel apparatus.
12. To determine the efficiency of a Differential Wheel and Axle apparatus.

COURSE OUTCOMES

At completion of the course, students will be able to

1. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
2. Apply basic knowledge of mathematics and physics to solve real-world problems.
3. Determine the coefficient of friction.
4. Determine the efficiency of a simple screw jack apparatus, Worm and Worm Wheel apparatus and Differential Wheel and Axle.
5. Estimate the value of acceleration due to gravity.

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3					3			2	2		
CO2	3	1	1	3					3			2	2		
CO3	3	1	1	3					3			2	2		
CO4	3	1	1	3					3			2	2		
CO5	3	1	1	3					3			2	2		

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)			B.Tech. II Semester	
Code: C0B18	**Engineering Chemistry Lab** (Common for CE, EEE, ME,ECE,CSE,CSE(AIML), CSE(DS), CSE (CS), CSE(IOT),IT and Min.E))	L	T		P
Credits: 1		-	-		2

Course Objectives:

To provide the students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technicalcompetence.

List of Experiments:

1. Calibration of Volumetric apparatus.
2. Estimation of Total Hardness of water by EDTA Method.
3. Estimation of an acid by P^H metry.
4. Estimation of alkalinity of water.
5. Estimation of strength of an acid by Conductometry.
6. Estimation of strength of an acid by Potentiometry.
7. Estimation of Mn^{+2} ion in KMnO4 by Colorimetry.
8. Determination of viscosity of given liquids by Ostwald's viscometer.
9. Determination of surface tension of given sample using stalagmometer.
10. Estimation of iron (II) by dichrometry.
11. Determination of rate constant of hydrolysis of methyl acetate.
12. Preparation of Aspirin.

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

1. Estimate the hardness of given water samples.
2. Select lubricants for various purposes.
3. Prepare advanced polymers & drug materials.
4. Know the strength of an acid present in batteries.
5. Calculate the amount of Mn^{+2} present in unknown substances/ores using instrumentalmethods.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1											
CO2	2	1	2												
CO3	2	2		1											
CO4	2	2	1												
CO5	2	1	2												

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: C0B13	**Engineering Physics Lab** (Common to ME, CE and Min. E)	**L**	**T**	**P**
Credits: 1		-	-	2

Course objectives:

The main objective of this course is to provide the necessary exposure to the practical aspects, which is an essential component for learning science.

List of Experiments:

1 **Melde's Experiment – Longitudinal and Transverse modes**
   To determine frequency of electrically maintain Tuning fork using Melde's apparatus.

2 **RLC series circuit**
   To determination of resonant frequency, bandwidth and quality factor.

3 **Ultrasonic Interferometer**
   To determine the velocity of ultrasonic sound through different liquid media..

4 **Numerical Aperture of an Optical Fiber**
   To determine the Numerical aperture of the given fiber.

5 **Bending loss of the given fiber**.
   To determine the bending loss of the given fiber.

6 **Diffraction grating**
   To determine the wavelength of LASER using Diffraction grating.

7 **B-H Curve**
   To study the Magnetization of Ferro magnetic material in presence of magnetic field.

8 **Dispersive Power**
   To determine the dispersive power of glass prism.

9 **LASER**
   To determination of pitch of the screw gauge using LASER.

10 **Torsional Pendulum**
   Determine the rigidity Modulus of given Wire.

11 **Sonometer**
   To verify the frequency of AC power Supply**.**

12. **NDT** – Magnetic particle testing

Course Outcomes:

At the end of the course, students will be able to
1. Develop skills to impart practical knowledge in real time solution.
2. Understand principle, concept, working, application and comparison of results with theoretical calculations.
3. Design new instruments with practical knowledge.
4. Understand measurement technology
5. Use new instruments and real time applications in engineering studies.

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1												
CO2	3	1	1												
CO3	3														
CO4	3														
CO5	3														

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22))	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code: C0314	FLUID MECHANICS AND HYDRAULIC MACHINES	L	T	P
Credits: 3	[Common to EEE and Min.E]	3	-	-

Prerequisites: Nil

Course Objectives:

The objective of this subject is to provide the knowledge of fluid power and analyze the performance of various hydraulic machines like turbines, compressors and pumps.

MODULE I: FLUID STATICS   10 PERIODS

Dimensions and units: physical properties of fluids- specific gravity, viscosity surface tension-vapor pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure – measurement of pressure- Piezometer, U-tube and differential manometers.

Hydro static forces on plane and curved surfaces. Buoyancy and floatation: Meta center, stability of floating body, Submerged bodies, Calculation of metacentric height.

MODULE II: FLUID KINEMATICS & FLUID DYNAMICS   10 PERIODS

Fluid kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow. Velocity potential and stream function – flow net.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, Measurement of flow: pitot tube, venturimeter and orifice meter, Flow nozzle, Turbine flow meter, momentum equation and its application on pipe bend.

MODULE III: Closed Conduit Flow & Boundary Layer Concepts   10 Periods

A: Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel - total energy line - hydraulic gradient line.

B: Boundary Layer Concepts: Definition, thickness, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

MODULE IV: Turbo machinery and Hydraulic Turbines   09 Periods

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, workdone and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, workdone, efficiencies, hydraulic design – draft tube theory - functions and efficiency. Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

MODULE V: Centrifugal Pumps & Reciprocating Pumps   09 Periods

Centrifugal pumps: Classification, working, work done – manomertic head- losses and

efficiencies specific speed- pumps in series and parallel-performance characteristic curves,
NPSH. Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

TEXT BOOKS

1. Modi and Seth, "**Hydraulics, fluid mechanics including hydraulic machines**", Standard Publishers, 19th Edition, 2013
2. R.K. Bansal, "**Fluid Mechanics and hydraulic Machines**", Laxmi Publications, 9th Edition, 2010.

   REFERENCES

1. R.K. Rajput, "**Fluid Mechanics and Hydraulic Machines**", S.Chand, 5th Edition, 2013.
2. D. Rama Durgaiah, **"Fluid Mechanics and Machinery"**, New Age International (P) Ltd, 1st editions, 2007
3. James W. Dally, William E. Riley **"Instrumentation for Engineering Measurements",** John Wiley & Sons Inc. 3rd editions, 1989.
4. Vijay Gupta and S.K.Gupta, "**Fluid Mechanics and Applications**", New-Age Intern
5. Banga & Sharma, "**Hydraulic Machines**", Khanna Publishers, 7th Edition, 2007

E - RESOURCES

1. nptel.ac.in/courses/112105183/
2. www.nptelvideos.in/2012/11/fluid-mechanics.htm
3. nptel.ac.in/courses/112104117/
4. www.sanfoundry.com/best-reference-books-fluid-mechanics-and-machinery/
5. https://www.elsevier.com/journals

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Know the dimension and units of fundamental properties.
2. Understand the concept of fluid kinematics and dynamics.
3. Understand and solve the problems of closed conduit flow & boundary layer concepts.
4. Analyze the performance of turbo machinery and hydraulic turbines.
5. Understand the principles of centrifugal and reciprocating pumps.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		3	2	1						3	3		
CO2	3	3		3	2	1						3	3		
CO3	3	3		3	2	1						3	3		
CO4	3	3		3	2	1						3	3		
CO5	3	3		3	2	1						3	3		

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE	B. Tech
	(Autonomous)	III Semester
Code: C0252	ELECTRICAL MACHINES AND CONTROLS	L	T	P
Credits: 3		3	-	-

PREREQUISITE: NIL

Course Objectives:

To impart knowledge on Basics of electric drives, Different speed control methods, various motor starters and controllers, instrumentation and its applications.

MODULE-I: INTRODUCTION 10 PERIODS

Fundamentals of electric drives – advances of electric drive-characteristics of loads – different types of mechanical loads – choice of an electric drive – control circuit components: Fuses, switches, circuit breakers, contactors. Relay – control transformers.

MODULE-II: SPEED CONTROL OF DC MACHINES 10 PERIODS

DC shunt motors – Speed Torque characteristics - Ward Leonard method, DC series motor – series parallel control – solid state DC drives – Thyristor bridge rectifier circuits chopper circuits.

MODULE-III: Speed Control of AC Machines 10 Periods

A: Induction motor – Speed torque Characteristics – pole changing, stator frequency variation - slip-ring induction motor – stator voltage variation - Rotor resistance variation,

B: Slip power recovery – basic inverter circuits- variable voltage frequency control.

MODULE-IV: Motor Starters and Controllers 09 Periods

DC motor starters using voltage sensing relays, current sensing relays and time delay relays - wound rotor induction motor starters – starters using frequency sensing relays -DOL -starter

MODULE-V: INSTRUMENTATION 09 PERIODS

Flame proof equipments, intrinsically safe equipments,

Dissolved O_2 Analyzer: Conductivity meter – pH meter – Dissolved oxygen analyser – Silica analyser – Turbidity meter – Gas analyser – NOx analyser – H2S analyser – CO and CO2 monitor, Dust & Smoke measurement.

TEXT BOOKS:

1. N.K De and P .K Sen 'Electric Drives' Prentice Hall of India Private Ltd, 2002.
2. Vedam Subramaniam 'Electric Drives' Tata McGraw Hill , New Delhi,2007
3. G.K.Dubey. 'Fundamentals of Electrical Drives' Narosa, Second Edition.
4. Alan S. Morrris. Principles of Measurement and Instrumentation, Print ice-Hall of India Pvt., Ltd. New Delhi, 1999.
5. Ernest O Doeblin. Measurement Systems Application & Design, Tata McGraw Hill Publishing Co., New. Delhi, 1999

REFERENCES:

1. S.K Bhattacharya, Brinjinder Singh 'Control of Electrical Machines' New Age International Publishers,2002.
2. John Bird 'Electrical Circuit theory and technology' Elsevier, First Indian Edition, 2006.
3. Murthy, D.V.S. Transducers and Instrument and Instrumentation, Prentice Hall of India Pvt. Ltd. New Delhi.

4. Liptak B.G. Instrumentation Engineers Hand Book (Measurement), Chilton Book Co., 1994.

E - RESOURCES

1. https://www.electrical4u.com/induction-motor-types-of-induction-motor/
2. https://www.eeweb.com/electromechanical
3. https://www.electrical4u.com/electrical-drives/
4. http://nptel.ac.in/courses/108108077/
5. http://nptel.ac.in/courses/108106072/

COURSE OBJECTIVES:

1. To develop fundamentals of electrical drives and machines
2. Design of speed controls of DC machines
3. Develop of motors and controllers
4. To know about instrumentation.
5. To know deep knowledge about current sensing relays

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
CO S	**Programme Outcomes (POs)**												**PSOS**		
	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	2	2									2			
CO2	3	2	2									2			
CO3	3	2	2									2			
CO4	3	2	2									2			
CO5	3	2	2									2			

2022-23 Onwards (MR-22)	**MALLA REDDY ENGINEERING COLLEGE** (Autonomous)		**B. Tech III Semester**		
Code: C2501	**MINE SURVEYING**		**L**	**T**	**P**
Credits: 3			3	-	-

Prerequisite: Basics of Mathematics and Surveying

Course Objectives:

Ability to apply knowledge of mathematics in surveying to calculate areas and volumes for different projects. Ability to identify, formulate and solve problems in the field of advanced surveying. Ability to analyze survey data and design mining engineering projects. Ability to engage in life- long learning with the advances in survey techniques.

Module 1: Surveying & Levelling   **10 Periods**

Surveying**:** Overview of surveying, objectives, principles, primary divisions and classification, Distance measurement using conventional methods. Direct and indirect ranging, Errors in surveying. Corrections of linear measurements.

Levelling: Overview of levelling, objectives, levelling instruments, important terms used in levelling, classification of levelling, methods of levelling, errors in levelling

Module 2: Traversing with compass and contouring   **10 Periods**

Principles of Traversing, traversing with surveying instruments, traversing with compass. Bearings, Azimuth, Meridian and declination.

Overview of contouring, characteristics of contouring, use of contours in mining industries

Module 3: Traversing with Theodolite   **10 Periods**

Construction of theodolite, parts of theodolite, adjustments of theodolite, errors in theodolite. Measurement of horizontal angles, measurement of vertical angles, theodolite traverse and calculation of coordinates and balancing of traverse.

Module 4: correlation survey, curve surveying, tachometry   **09 Periods**

 Correlating surface to underground through two shafts, correlating surface to underground through one shaft- by i) Co-planning method, ii) weisbach triangle method.

Types of curves, curve ranging, setting out simple curves- linear method, offset from long chord. Definition, Finding "K" and "C" constants of tachometer. Measuring the horizontal and vertical distances using different methods of tachometry.

Module 5: Photogrammetric survey, GPS, advancements of survey in mining   **09 Periods**

Basics of Photogrammetric, Application of photogrammetry in laser scanners and drones.Advantages and disadvantages of photogrametry. Basics of GPS, Application of GPS in mining. Advancements of mine surveying using modern instruments. Basics of EDM and total station. Regulations regarding types of mine plans- preparation and maintenance of mine plans.

TEXT BOOKS:

1. Surveying (Vol-1,2& 3) by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain- Laxmi Pubicaions (P) Ltd., NewDelhi.
2. Surveying and leveling (Vol 1 & 2) – Kanitkar, A.V.G. Prakash
3. Surveying (Vol – 1,2 & 3), by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) Ltd., NewDelhi.
4. Surveying (Vol 1,2& 3), Duggal S.K. Tata Mc.Graw Hill Publishing Co.Ltd. New Delhi, 2004

REFERENCES:

1. Elements of Plane Surveying, Arthur R. Benton and Philip J Taetly, McGrawHill-2000
2. Surveying Vol 1 & 2 & 3, Arora K R Standard Book House, Delhi,2004.
3. Plane Surveying, Chandra A M, New age International Pvt. Ltd., Publishers, New Delhi, 2002.
4. Apply Principles of triangulation survey. Text book of surveying by C. Venkataramaiah, UniversitiesPress.
5. Higher Surveying, Chandra A M. ,New age International Pvt. Ltd. Publisher, New Delhi,2002
6. Surveying and leveling by R. Subramanian, Oxford University Press, NewDelhi

E RESOURCES:

1. http://www.ism-minesurveying.org/mine-surveying.html
2. http://www.minesurveyor.net/
3. http://www.pobonline.com/articles/84226-underground-surveying
4. http://www.ism-minesurveying.org/mine-surveying.html
5. http://www.springer.com/gp/book/9781504123679

Course Outcomes:

At the end of the course, students will be able to

1: Understand basics and historical methods of survey.

2: Understand application Leveling as a part of surveying.

3: Understand traversing methods using various survey instruments.

4: Understand the fundamentals of triangulation survey.

5: Understand contours and using contours for calculations.

<table>
<tr><th colspan="15">CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</th></tr>
<tr><th rowspan="2">CO S</th><th colspan="11">Programme Outcomes(POs)</th><th colspan="3">PSOS</th></tr>
<tr><th>PO1</th><th>PO2</th><th>PO3</th><th>PO4</th><th>PO 5</th><th>PO 6</th><th>PO 7</th><th>PO 8</th><th>PO9</th><th>PO10</th><th>PO11</th><th>PO12</th><th>PSO 1</th><th>PSO 2</th><th>PSO 3</th></tr>
<tr><td>CO1</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td></td><td>3</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>CO2</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td>2</td><td></td><td>1</td><td></td><td></td><td>2</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>CO3</td><td>3</td><td>2</td><td>2</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>2</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>CO4</td><td>3</td><td>1</td><td>2</td><td></td><td>2</td><td>1</td><td>2</td><td></td><td>2</td><td></td><td></td><td>1</td><td>3</td><td>2</td><td>2</td></tr>
<tr><td>CO5</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td>1</td><td></td><td>1</td><td></td><td></td><td>2</td><td>3</td><td>1</td><td>2</td></tr>
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2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code: C0309	MACHINE DRAWING	L	T	P
Credits: 2		2	-	-

Prerequisites: Engineering Graphics

COURSE OBJECTIVES:

To understand projections of simple machine elements and understand assembly drawings of typical machine parts such as Connecting rod, Eccentric, Cross head, Screw jack, Plummer block.Machine Drawing Conventions:

Need for drawing conventions - introduction to IS conventions

  a) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features
  b) Types of sections - selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
  c) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs, springs.
  d) Title boxes, their size, location and details - common abbreviations & their liberal usage
  e) Assembly drawings - working drawings of machine parts.

I. DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS:

  Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

  a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
  b) Keys, cotter joints and knuckle joint, bolted joint.
  c) Riveted joints for plates
  d) Shaft coupling, flange coupling and universal coupling, socket and spigot joint.

II. ASSEMBLY DRAWINGS:

  a) Engine parts - Stuffing boxes, Cross heads, Eccentrics, Petrol Engine connecting rod, Piston assembly.
  b) Other machine parts - Screws jack, Milling machine tail stock, Plummer block, single tool post, Clapper block

TEXT BOOKS

 1. K.L.Narayana, P.Kannaiah **"Machine Drawing"**, New Age Publishers, 5th edition, 2016.
 2. RK Dhawan "**Machine Drawing"**, S.Chand Publications, Revised edition, 2014.
 3. N.D.Bhatt "**Machine Drawing",** Charotar Publishing House pvt ltd, 48thedition, 2013.

REFERENCES

 1. P.S.Gill "**Machine Drawing"**, S.K. Kataria & Sons Publisher, 17th edition, 2009.
 2. Rajput "**Machine Drawing",** Lakshmi Publications
 3. K.C.JOHN "**Machine Drawing**", PHI Learning Pvt Ltd, 2009
 4. N.D. Junnarkar "**Machine Drawing**", Pearson Education India, 2007.

E – RESOURCES

1. http://nptel.ac.in/courses/105108069/
2. http://www.me.metu.edu.tr/courses/me114/Lectures/assembly.htm
3. http://www.nature.com/nature/journal/v58/n1510/abs/058543c0.html

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Know the basic conventional representation of materials which is fundamental to the subject.
2. Know the nomenclature of threads, bolts, nuts, set screws and taps.
3. Know the importance of joints like cotter joints, knuckle joint and also come to know how the power being transmitted from one shaft to other.
4. Draw the Journal bearings, collar and foot step bearings.
5. Draw the assembly drawings of machine parts.

COS	CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

<table>
<tr><th colspan="16" align="center">CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</th></tr>
<tr><th rowspan="2">COS</th><th colspan="12">Programme Outcomes(POs)</th><th colspan="3">PSOs</th></tr>
<tr><th>PO1</th><th>PO2</th><th>PO3</th><th>PO4</th><th>PO5</th><th>PO6</th><th>PO7</th><th>PO8</th><th>PO9</th><th>PO10</th><th>PO11</th><th>PO12</th><th>PSO1</th><th>PSO2</th><th>PSO3</th></tr>
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<tr><td>CO4</td><td>2</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>1</td><td></td><td>3</td><td></td><td>3</td><td>3</td><td></td><td></td></tr>
<tr><td>CO5</td><td>2</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>1</td><td></td><td>3</td><td></td><td>3</td><td>3</td><td></td><td></td></tr>
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2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B. Tech III Semester		
Code: C2502	DEVELOPMENT OF MINERAL DEPOSITS	L	T	P
Credits: 3		3	-	-

Prerequisite: Under graduate Physics, Chemistry and Math's.

COURSE OBJECTIVES:

To demonstrate the importance of mining in national economy, understand the terminology associated with the discipline and be familiar with the available regulatory mechanism to enable safe & sustainable mining operations. To know the history of mining and describe the correlation between the development of mining and cultural progress. To introduce the field of mining and provide basic input about mining unit operations. To learn the various modes of access and study the methods of designing the access.

MODULE-I: INTRODUCTION TO MINING ENGINEERING   10 PERIODS

Significance of mining industry in national economy and infrastructure building, basic mining terminologies, mineral types as per law, stages in mine life cycle, Economic, Social, Environmental and Health impacts of Mining. Industrial progress and mining.

Knowing about deposit through exploration. Classification of mining methods and their selection criteria. Scheme of mining.

Opening up of deposits: Types, size and location of entries into underground coal and other minerals.

MODULE-II: MINE ENTRIES   10 PERIODS

Selection criteria of mode of entry between shaft, Incline and Adit. Preliminary investigations about strata for making entry and equipment. Methods of sinking shaft in water-logged, pressurized strata in loose and running soils. Mechanized shaft sinking methods. Need for widening and deepening of operating shafts. Different methods for widening and deepening shafts. Design of shaft insets, pit bottom excavation.

MODULE-III: DEVELOPMENT OF WORKINGS   10 PERIODS

A: Drivage of cross cuts, drifts, inclines and raises by conventional and mechanized methods. Pull and progress, Calculation of OMS.

B: Arrangements for loading transportation ventilation, support, lighting, and drainage. Drilling patterns, blast design parameters and explosives for underground coal mines and hard rock mines.

MODULE-IV: ENVIRONMENTAL PROTECTION   09 PERIODS

Introduction to environmental maintenance and controlling pollutions. Restoration of land to its shape productivity and environment. Planning of mine closure.

Legal provisions for development of workings.

MODULE-V: Modern Technologies for mine development   09 Periods

Modern drill zambos, modern loading and transporting equipment for development of drivages, Tunnel boring machine and its application, Mechanized methods of shaft sinking. Drop rising. Risk to health and safety of workmen, rescue, first aid.

TEXT BOOKS:
1. Introductory mining engineering-, Howard L.Hartman, Jan M.Mutmansky/ wileyIndia (P) Ltd
2. Elements of mining technology Vol-I - D.J. Deshmukh /Denett&Company
   REFERENCES:
1. Roy Piyush Pal, Blasting in ground excavations and mines, Oxford and IBH, 1st ed 1993
2. C.P. Chugh, Drilling technology handbook, Oxford and IBH, 1sted,1977

E RESOURCES:
1. https://www.nap.edu/read/10318/chapter/5#23
2. http://www.alta.eu/commodities/mining-technology/surface-mining/long-distance-beltconveyors/
3. Indian Mining Journal

COURSE OUTCOMES:

At the end of the course the student will be able to

    1:Know the status and significance of mining Industry.

    2:Apply different methods of Shaft sinking according to the ground conditions.

    3:Know about Development of workings.

    4:Know about different types of supports, their advantages and disadvantages.

    5:Know about different tunnelling methods.

<table>
<tr><td colspan="15" align="center">CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
<tr><td rowspan="2">COS</td><td colspan="11" align="center">Programme Outcomes(POs)</td><td colspan="3" align="center">PSOS</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>PO9</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td><td>PSO3</td></tr>
<tr><td>CO1</td><td>3</td><td>2</td><td>2</td><td></td><td>1</td><td></td><td></td><td>1</td><td></td><td></td><td></td><td>3</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>CO2</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td>2</td><td></td><td>1</td><td></td><td></td><td>2</td><td>2</td><td>2</td><td>1</td></tr>
<tr><td>CO3</td><td>3</td><td>2</td><td>2</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>2</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>CO4</td><td>3</td><td>1</td><td>2</td><td>2</td><td>1</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td><td>1</td><td>3</td><td>2</td><td>2</td></tr>
<tr><td>CO5</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td>2</td><td>3</td><td>1</td><td>2</td></tr>
</table>

Note: PO5 column header reads "PO 5", PO6 "PO 6", PO7 "PO 7", PO8 "PO 8", PO9 "PO 9", PO10 "PO1 0", PO11 "PO1 1", PSO1 "PSO 1", PSO2 "PSO 2", PSO3 "PSO 3"

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B.Tech. III Semester	
Code: C0354	**BASIC MECHANICAL ENGINEERING**	**L**	**T**	**P**
Credits: 2		**2**	**-**	**-**

Prerequisite:

Course Objectives: This course will develop student's knowledge in types of materials, design methodology and elements of power transmission, different manufacturing processes and their applications. Laws of thermodynamics and types of systems, principle and applications of IC engines

MODULE – I: Engineering Materials

Engineering Materials: Classification, properties and applications Design Criterion: Discrete steps in engineering design process Power Transmission: Classification; flat belt drives - length of open and cross belts, belt tensions and power transmitted; Gears-types and applications; spur gear-nomenclature Bearings: Types – sliding& rolling contact bearings and applications;

MODULE – II: Manufacturing Processes

Manufacturing Processes: Classification; Foundry- steps in sand casting process; pattern-types, materials and allowances, mould cross section, moulding sand-composition and properties; Machining: lathe machine-line diagram and operations; Welding-classification; principle of arc welding- AC and DC welding, principle of gas welding, principle of brazing and soldering; Metal forming process: forging, rolling, extrusion.

MODULE – III: Thermodynamics

Thermodynamics: System-types, state, property, process and cycle; Energy-property; Zeroth law, thermodynamic equilibrium, laws of perfect gases.

Law of Thermodynamics: First law- applied to a cycle, change of state, Internal energy, Enthalpy; Work and Heat in closed systems- Isobaric, Isochoric, Isothermal, Adiabatic and Polytrophic; PMM-I, limitations of first law of thermodynamics.

MODULE – IV: Second Law of Thermodynamics

Second Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their equivalence; Carnot cycle, Carnot theorem, heat engine, heat pump and refrigerator; working principle of domestic air conditioner-line diagram.

MODULE – V: IC Engines & Air Compressors

IC Engines: Classification; working principle of four and two stroke SI and CI engines.

Air compressors: Classifications, working principle of single stage and two stage air compressors.

Text Book:

5. Mathur, Mehta and Tiwari, "Elements of Mechanical Engineering", Jain Brothers, New Delhi,2017.

Reference Books:

1. Hazra Chowdary. S. K and Bose, "Basic Mechanical Engineering", Media Promoters and Publishers Pvt. Ltd, India, 2010.
2. P. K. Nag, "Engineering Thermodynamics", Tata McGraw Hill, New Delhi.
3. Hazra Chowdary. S. K and Bose, "Workshop Technology, Vol. I & II", Media Promoters and Publishers Pvt Ltd, India.

Course Outcomes

At the end of the course the student will be able to

1: Explain mechanical properties of an engineering materials and learn the steps in design methodology

2: Describe the principles of manufacturing process.

3: Apply first law of thermodynamics to various processes to calculate work and heat for a closed system.

4: Design second law of thermodynamics and demonstrate the working principle of IC engines.

5: Explain and demonstrate the working principle of single stage and two stage air compressors

COS	Programme Outcomes (POs)												PSOS		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											1	1	
CO2	2												1	1	
CO3	2	2											1	1	
CO4	2	2											1	1	
CO5	2	2											1	1	

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B.Tech. III Semester	
Code: C0318	**FLUID MECHANICS AND HYDRAULIC MACHINES LAB** [Common to EEE and Min.E]	**L**	**T**	**P**
Credits:1		-	-	2

COURSE OBJECTIVES:

To provide practical knowledge of fluid flow properties, flow losses, performance testing of hydraulic turbines and hydraulic pumps.

List of Experiments

1. Performance test on impact of jet on Vanes.
2. Performance test on Pelton Wheel.
3. Performance test on Francis Turbine.
4. Performance test on Kaplan Turbine.
5. Performance test on Single Stage Centrifugal Pump.
6. Performance test on Multi Stage Centrifugal Pump.
7. Performance test on Reciprocating Pump.
8. Calibration of Venturi meter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of minor losses (sudden contraction, expansion, pipe bend and union) for a given pipeline.
12. Validation of Bernoulli's Theorem.

COURSE OUTCOMES:

At the end of the course, students will be able to

1. Analyze the performance of turbines.
2. Analyze the performance of centrifugal and reciprocating pump.
3. Analyze the performance of venturimeter and orifice meter.
4. Determine the minor losses in given pipe system.
5. Demonstrate the Bernoulli's equation in Bernoulli's apparatus.

COS	Programme Outcomes(POs)												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1		3	2	1			3			3	3		
CO2	3	1		3	2	1			3			3	3		
CO3	3	1		3	2	1			3			3	3		
CO4	3	1		3	2	1			3			3	3		
CO5	3	1		3	2	1			3			3	3		

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B. Tech III Semester		
Code: C2503	**MINE SURVEYING LAB**		**L**	**T**	**P**
Credits: 1			-	-	2

COURSE OBJECTIVES:

To familiarize with the various surveying instruments and methods.

LIST OF EXPERIMENTS:

1. Chain Surveying- Calculation of area and plotting.
2. Traversing with compass, finding bearing and calculation of interior angles and their adjustments.
3. Profile levelling: plotting the section by rise and fall method.
4. Contouring of an area.
5. Measurement of horizontal and vertical angles by theodolite
6. Traversing by theodolite.
7. Correlation by one shaft method- Weisbach triangle method.
8. Correlation by two shaft method.
9. Curve ranging offsets from long chord.
10. Curve ranging by Ranking's method.
11. Finding K and C constants of a tachometer.
12. Finding horizontal and vertical distance by tachometer

Course Outcomes

At the end of the course, students will be able to

1: Do the Range and to measure the distance between two points.

2: Conduct the chain triangulation survey.

3: Determine the area by using different

methods. **4:** Determine the elevation of a

given point.

5: Use the instruments used in the surveying.

COS	Programme Outcomes (POs)												PSOS		
	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		3			1				3	2	2	2
CO2	3	2	2			1	2		1			2	3	2	1
CO3	3	2	2		2		1					1	2	3	2
CO4	3	1	2			2	2		2			1	3	3	2
CO5	3	2	2			1			1			2	3	1	2

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B.Tech. III Semester	
Code: C0561	**Fundamentals of Data Structures Lab** (Common for CE, EEE, ME, ECE, MiE)	L	T	P
Credits: 2		-	1	2

Prerequisites: C Programming.

Course Objectives:
This course will deliver the knowledge in introducing the concepts of various data structures such as linked lists, stacks, queues, trees and graphs along with the applications.

Software Requirements: C

List of Programs:

1. Write a program to create one dimensional array, with the following operations:
 a) Insertion
 b) Deletion
 c) Display the elements
 d) Count number of elements
2. Write a program to create a single linked list, with the following operations:
 a) Insertion
 b) Deletion
 c) Display the elements
 d) Count number of elements.
3. Write a program to create a circular linked test with the following operations
 a) Insertion
 b) b) Deletion
 c) c) Display the elements
 d) d) Count number of elements
4. Write a program to create a double linked list, with the following operations
 a) Insertion
 b) Deletion
 c) Display the elements
 d) Count number of elements
5. Write a program to implements stack operations using
 a) Arrays
 b) Linked list
6. Write a program
 a) Evaluate postfix expression
 b) Convert infix expression into postfix expression
7. Write a program to implement Linear queue operations using:
 a) Arrays
 b) Linked list
8. Write a program to implements Circular Queue operations using Arrays
9. Write a program to implements Double-ended Queue operations using Arrays
10. Write a recursive program to create a Binary Tree of integers, traverse the tree in preorder, in order and post order of the tree.

11. Write a program to create a Binary Search Tree (BST) and perform insert and search operations on it.
12. Write a program for implementing the following graph traversal algorithms
    a)   Breadth First Search BFS   b) Depth First search DFS

TEXTBOOKS
1. Jean Paul Tremblay, Paul G Sorenson, "**An Introduction to Data Structures with Applications**", Tata McGraw Hills, 2nd Edition, 1984.
2. Richard F. Gilberg, Behrouz A. Forouzan, "**Data Structures: A Pseudo code approach with C** ", Thomson (India), 2nd Edition, 2004.

REFERENCES
1. Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan, "**Fundamentals of Data Structure in C**", University Press (India), 2nd Edition, 2008.
2. A. K. Sharma, "**Data Structures using C**", Pearson, 2nd Edition, June, 2013.
3. R. Thareja, "**Data Structures using C**", Oxford University Press, 2nd Edition, 2014.

COURSE OUTCOMES:
At the end of the course, students will be able to
1. Identify the appropriate recursive algorithms and analyze the performance of algorithms.
2. Understand and implement single, double, and circular linked-lists.
3. Implement linear data structures such as Stacks and Queues using array and linked-list representations.
4. Implement nonlinear data structures such as trees and graphs.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2										3	2	
CO2	2	2	3										2	3	
CO3		2	3											3	1
CO4		2	3										2	3	

PREREQUISITE:

OBJECTIVES:

An interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences, including geo systems, biology, chemistry, economics, political science and international processes. The ability to work effectively as a member of an interdisciplinary team on complex problem of environment.

MODULE I: ECOSYSTEMS: 5 PERIODS

Definition, Scope and Importance of ecosystem, Concept of ecosystem, Classification of ecosystems, Structure and Structural Components of an ecosystem, Functions of ecosystem, Food chains, food webs and ecological pyramids. Flow of energy.

Activity: Plantation.

MODULE II: NATURAL RESOURCES, BIODIVERSITY AND BIOTIC RESOURCES   5 PERIODS

NATURAL RESOURCES:

Classification of Resources: Living and Non-Living resources, Renewable and non-renewable resources. Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources–case studies. Energy resources: growing energy needs, introduction to renewable and non-renewable energy sources.

BIODIVERSITY AND BIOTIC RESOURCES: 4 PERIODS

Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and intrinsic values. Threats to Biodiversity (habitat loss, poaching of wildlife, man-wild life conflicts). Conservation of Biodiversity (In-situ and Ex- situ conservation),

Activity: case studies.

Module III: ENVIRONMENTAL POLLUTION AND CONTROL: 07 Periods

A) Classification of pollution and pollutants, Causes, effects and control technologies. Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Point and non-point sources of pollution, Major pollutant of water and their sources, drinking water quality standards.
B) Soil Pollution, Soil as sink for pollutants, Impact of modern agriculture on soil, degradation of soil. Marine Pollution: Misuse of International water for dumping of hazardous waste, Coastal pollution due to sewage and marine disposal of industrial effluents. E-waste and its management. Activity: Field visit.

MODULE IV: GLOBAL ENVIRONMENTAL PROBLEMS AND GLOBAL EFFECTS: 06 PERIODS

Greenhouse effect, Green House Gases (GHG), Global Warming, Sea level rise, climate change

and their impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions/Protocols: Earth summit, Kyoto protocol and Montréal Protocol.

Activity: Poster Making.

MODULE V: TOWARDS SUSTAINABLE FUTURE: 05 PERIODS

Concept of Sustainable Development, Threats to Sustainability, Population and its explosion, Crazy Consumerism, Over-exploitation of resources, Strategies for Achieving Sustainable development, Environmental Education, Conservation of Resources, Urban Sprawl, Sustainable Cities and Sustainable Communities, Human health, Role of IT in Environment, Environmental Ethics, Environmental Economics, Concept of Green Building, Clean Development Mechanism (CDM).

TEXT BOOKS:

1. R.Rajagopalan,**"Environmental Studies from crisis to cure"**, Oxford University Press 2nd Edition, 2005.
2. Anubha Kaushik, C.P.Kaushik, **"Environmental studies"** New age International Publishers,4th Edition,2012

REFERENCES:

1. Erach Bharucha,**"Environmental studies"** University Grants Commission, and University Press,I Edition, 2005.
2. M. Anji Reddy **"Text book of Environmental Science and Technology"** 3rd Edition, 2007
3. Richard T.Wright,**"Environmental Science: towards a sustainable future"** PHL Learning, Private Ltd. New Delhi, 2nd Edition., 2008
4. Gilbert McMasters and Wendell P.Ela,**"Environmental Engineering and science"**, 3rd Edition, PHI Learning Pvt. Ltd.,2008.

E-Resources:

1. http://www.gdrc.org/uem/ait-terms.html (Glossary of Environmental terms).
2. http://www.environmentalscience.org/ (Environmental sciences Lectures series). Journal of earth science and climatic change (OMICS International Journal).
3. Journal of pollution effects & control (OMICS International Journal).
4. nptel.ac.in/courses/120108004/ (Principles of Environment Management Lectures).
5. http://www.nptelvideos.in/2012/12/fundamentals-of-environmental-pollution.html(NPTEL online video courses IIT lectures).

COURSE OUTCOMES:

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

1. To enable the students to realize the importance of ecosystem, its structure, services. To make the students aware of Different natural functions of ecosystem, which helps to sustain the life on the earth.
2. To use natural resources more efficiently.
3. To make the students aware of the impacts of human actions on the environment, its effects and minimizing measures to mitigate them.
4. To educate the students regarding environmental issues and problems at local, national and international level.
5. To know more sustainable way of living

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1		1	2	1								
CO2	2	3	2	3	1	3		2							
CO3	3	3	2	3	2	2		1							
CO4	3	2	2	1	2	1									
CO5	2	1	1			1	3	3							

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

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Pre-requisite: Basic Probability

COURSE OBJECTIVES:

This course is meant to provide a grounding in Statistics and foundational concepts that can be applied in modeling processes and decision making. These would come in handy for the prospective engineers in most branches.

MODULE - I: PROBABILITY   **9 PERIODS**

Introduction to Probability, events, sample space, mutually exclusive events, Exhaustive events, Addition theorem for 2& n events and their related problems. Dependent and Independent events, conditional probability, multiplication theorem, Baye's Theorem, Statement of Weak law of large numbers

MODULE - II: RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS   **10 PERIODS**

Random variables – Discrete Probability distributions. Bernoulli, Binomial, poisson, mean, variance, moment generating function–related problems. Geometric distributions.

Continuous probability distribution, Normal distribution, Exponential Distribution, mean, variance, moment generating function–related problems. Gamma distributions (Only mean and Variance) Central Limit Theorem

MODULE - III: SAMPLING DISTRIBUTIONS & TESTING OF HYPOTHESIS   **11 PERIODS**

A: Sampling Distributions: Definitions of population-sampling-statistic, parameter. Types of sampling, expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means and sampling distribution of variance. Parameter estimations – likelihood estimate, point estimation and interval estimation.

B: Testing of hypothesis: Null hypothesis, Alternate hypothesis, type I, & type II errors – critical region, confidence interval, and Level of significance. One tailed test, two tailed test.

Large sample tests:

1. Testing of significance for single proportion.
2. Testing of significance for difference of proportion.
3. Testing of significance for single mean.
4. Testing of significance for difference of means.

MODULE IV: SMALL SAMPLE TESTS   **09 PERIODS**

Student t-distribution, its properties; Test of significance difference between sample mean and population mean; difference between means of two small samples, Paired t-test, Snedecor's F-distribution and it's properties. Test of equality of two population variances, Chi-square distribution, its properties, Chi-square test of goodness of fit and independence of attributes.

MODULE V: CORRELATION & REGRESSION   **09 Periods**

Correlation, Coefficient of correlation, the rank correlation. Regression Coefficient, The lines of regression: simple regression.

TEXT BOOKS:

1. Walpole, Probability & Statistics, for Engineers & Scientists, 8th Edition, Pearson Education.
2. Paul A Maeyer Introductory Probability and Statistical Applications, John Wiley Publicaitons.
3. Monte Gomery, "Applied Statistics and Probability for Engineers", 6th Edition, Wiley Publications.

REFERENCES:

1. Sheldon M Ross, Introduction to Probability & Statistics, for Engineers & Scientists, 5th Edition, Academic Press.
2. Miller & Freund's , Probability & Statistics, for Engineers & Scientists, 6th Edition, Pearson Education.
3. Murray R Spiegel, Probability & Statistics, Schaum's Outlines, 2nd Edition, Tata Mc. Graw Hill Publications.
4. S Palaniammal, Probability & Queuing Theory, 1st Edition, Printice Hall.

E -RESOURCES:

1. http://www.csie.ntu.edu.tw/~sdlin/download/Probability%20&%20Statistics.pdf
2. (Probability & Statistics for Engineers & Scientists text book)
3. http://www.stat.pitt.edu/stoffer/tsa4/intro_prob.pdf (Random variables and its distributions)
4. http://users.wfu.edu/cottrell/ecn215/sampling.pdf (Notes on Sampling and hypothesis testing)
5. http://nptel.ac.in/courses/117105085/9 (Mean and variance of random variables)
6. http://nptel.ac.in/courses/111105041/33 (Testing of hypothesis)
7. http://nptel.ac.in/courses/110106064/5 (Measures of Dispersion)

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. The students will understand central tendency and variability for the given data.
2. Students would be able to find the Probability in certain realistic situation.
3. Students would be able to identify distribution in certain realistic situation. It is mainly useful for circuit as well as non-circuit branches of engineering. Also, able to differentiate among many random variables Involved in the probability models. It is quite useful for all branches of engineering.
4. The student would be able to calculate mean and proportions (large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations.
5. The student would be able to calculate mean and proportions (small sample) and to make important decisions from few samples which are taken out of unmanageably huge populations.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	4		3					3	1			
CO2	3	3	2		3			2	1		2				
CO3	3	2	1		3					2	3				
CO4	3	3	2		2		1		1			1			
CO5	3	2	2												

Prerequisites: Physics of Materials and Engineering Mechanics

Course Objectives:
The objective of this subject is to provide the basic concepts of mechanical behaviour of the materials under various loads, provides knowledge on shear force and bending moment diagrams of beams and knowledge about stress distribution across various cross sections of beams.

MODULE I: SIMPLE STRESSES & STRAINS   **10 Periods**
Elasticity and plasticity – Types of stresses & strains – Hooke's law – stress–strain diagram for ductile and brittle material–Working stress–Factor of safety–Lateral strain, Poisson's ratio & volumetric strain. Elastic Module & the relationship between them–Bars of varying section–composite bars– Temperature stresses. Strain energy – Resilience–Gradual, sudden, impact and shock loadings

MODULE II: Shear Force and Bending Moment   **10 Periods**
Definition of beam –Types of beams–Concept of shear force and bending moment–SF and BM diagrams for cantilever, simply supported and overhanging beams subjected to point loads, UDL, UVL and combination of these loads–Point of contra flexure–Relation between SF and BM and rate of loading at section of a beam

MODULE III: BENDING STRESSES & SHEAR STRESSES   **10 PERIODS**
A: Bending Stresses: Theory of simple bending– Assumptions– Neutral axis – Derivation of bending equation: $M/I = f/y = E/R$ –Determination bending stresses– section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections–Design of simple beam sections.
B: Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections – rectangular, circular, triangular, I, T and angle sections.

MODULE IV: Deflection of Beams &Torsion   **09 Periods**
Deflection of Beams**:** Bending into a circular arc–slope, deflection and radius of curvature – Differential equation for the elastic line of a beam– Double integration and Macaulay's methods– Determination of slope and deflection for cantilever and simply supported beams subjected to point loads- UDL – uniformly varying load.
Torsion: Theory of pure torsion – Assumptions – Derivation of torsion equation, polar section modulus – power transmitted by shafts – combined bending and torsion.

MODULE V: ANALYSIS OF PIN JOINTED PLANE FRAMES & THIN CYLINDERS   **09 PERIODS**
Analysis of Pin- Jointed Plane Frames**:** Determination of forces in the members of various types of cantilever & simply supported trusses using (i) Method of Joints (ii) Method of Sections.
Thin Cylinders**:** Thin seamless cylindrical shells–Derivation of formula for longitudinal and circumferential stresses– hoop, longitudinal and volumetric strains– changes in diameter and volume of thin cylinder

TEXT BOOKS
1. S.Timshenko **"Strength of Materials",** D. Van Nostr and Company, inc., 3rd edition, 1983
2. Ramamrutham **"Strength of materials",** Dhanpat Rai Publishing, 18th edition, 2014

REFERENCES

1. R..K. Rajput, **"Strength of Materials"** S. Chand company Pvt, 5th edition, 2014
2. R K Bansal **"Strength of Materials"** Lakshmi – publications, 6th edition, 2015
3. Bhavikatti **"Strength of materials"** Lakshmi publications, 4th edition, 2014.
4. R S Khurmi, **"Strength of Materials"** S Chand, revised edition, 2013.
5. D. S. Kumar, **"Strength of Materials,** S K Kataria & Sons, Reprint 2013.

E - RESOURCES

1. nptel.ac.in/courses/112107147
2. nptel.ac.in/courses/Web course- contents/.../strength%20of%20materials/homepage.htm
3. www.springer.com › Home › Materials › Characterization & Evaluation of Materials
4. discovermagazine.com/tags/strength of materials
5. nptel.ac.in/courses/105105108/
6. nptel.ac.in/courses/105105108/30

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Describe the fundamentals about the simple stresses, strains and deformation in components due to external loads.
2. Draw the shear force and bending moment diagrams for various beams.
3. Understand bending stress and shear stress.
4. Determine the deflection of beams and torsion.
5. Solve pin joint, thin cylinder problems.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3		3						3	3		
CO2	3	3	1	3		3						3	3		
CO3	3	3	1	3		3						3	3		
CO4	3	3	1	3		3						3	3		
CO5	3	3	1	3		3						3	3		

Prerequisite: Under graduate Physics and Chemistry

COURSE OBJECTIVES:

To introduce fundamentals of mining geology to the student emphasizing the importance of properties of rocks, soils and minerals. Course is also aimed at explanation of geology of tunnels, geology of bore hole drilling and excavation.

MODULE-I: LAND FORMS AND MINERALOGY   10 PERIODS

Origin or mode of development, characteristic features and engineering considerations of land forms developed by rivers, wind, oceans and volcanoes

Mineralogy: physical and chemical properties, classification of minerals and properties of common silicate minerals, oxides and sulphides.

MODULE-II: PETROLOGY   10 PERIODS

Igneous rocks: Magma and lava, extrusive and intrusive forms, classification and description of some common igneous rocks.

Sedimentary rocks: Sedimentation process, classification and description of some common sedimentary rocks

Metamorphic rocks: Process of metamorphism, textures and structures of metamorphic rocks, classification and description of some metamorphic rocks

MODULE-III: STRUCTURAL GEOLOGY AND STRATIGRAPHY

A: Structural Geology   **10 Periods**

Strike and dip, fundamental type, characteristic features and mechanics of folds, faults, joints and unconformities.

B: STRATIGRAPHY

Principles of stratigraphy, geological time scale.

MODULE-IV: GENESIS OF MINERAL DEPOSITS   09 PERIODS

Definition of ore, gangue, tenor and grade of ore, processes and formation of ore deposits including coal and petroleum

Mineral Resources of India: Major and minor mineral resources of India, origin and distribution

MODULE-V: MINERAL EXPLORATION   09 PERIODS

Geological, geophysical and geochemical exploration of mineral deposits, Estimation and determination of mineral reserves by different methods

TEXT BOOKS:

1. Mining Geology by Arogya Swamy, Oxford & IBH Publishing Company ,(1996)
2. Mining Geology by Mc Kinstry, Prentice-Hall

REFERENCES:

1. Mineral Resources of India by Krishna Swamy, Oxford & IBH,2nd edition (1984)
2. Engineering Geology & Geotechnics by Krynine and Hudd/McGraw-Hill.
3. Economic Mineral Deposits Alan M. Bateman (Author), M.L. Jensen (Editor), John Wiley & Sons Inc; 3rd edition (1979).

E RESOURCES:

1. http://dmg.kerala.gov.in/
2. http://www.mininggeology.ausimm.com.au/

COURSE OUTCOMES:

At the end of the course, students will be able to

1:Know different types of land forms formed by rivers,wind, oceans and volcanoes.

2:Know igneous rocks, Sedimentary rocks, and metamorphic rocks.

3:Know Structural Geology and Stratigraphy.

4:Know Genesis of Mineral deposits and Mineral Resources of India.

5:Know Geological, geophysical and geochemical exploration of mineral deposits.

<table>
<tr><td colspan="16" align="center">CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
<tr><td rowspan="2">COS</td><td colspan="12">Programme Outcomes (POs)</td><td colspan="3">PSOS</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>PO9</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td><td>PSO3</td></tr>
<tr><td>CO1</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td></td><td>3</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>CO2</td><td>3</td><td>2</td><td>2</td><td></td><td></td><td></td><td>2</td><td></td><td>1</td><td></td><td></td><td>2</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>CO3</td><td>3</td><td>2</td><td>2</td><td></td><td>2</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>2</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>CO4</td><td>3</td><td>1</td><td>2</td><td></td><td>2</td><td>1</td><td>2</td><td></td><td>2</td><td></td><td></td><td>1</td><td>3</td><td>2</td><td>2</td></tr>
<tr><td>CO5</td><td>3</td><td>2</td><td>2</td><td></td><td>2</td><td></td><td></td><td></td><td>1</td><td></td><td></td><td>2</td><td>3</td><td>1</td><td>2</td></tr>
</table>

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code: C2505	**MINE ENVIRONMENTAL ENGINEERING - I**	**L**	**T**	**P**
Credits: 3		3	-	-

Prerequisite: Fundamentals of Fluid Mechanics

COURSE OBJECTIVES:
Students should be aware of the principles of ventilation and basic ventilation systems.

MODULE-I: MINE GASES   10 PERIODS
Atmospheric air – its composition, mine air – its general composition, origin, physical and chemical properties of mine gases, physiological effects of breathing mine gases and its detection, sampling and analysis of mine air, methane drainage.

MODULE-II: HEAT, HUMIDITY AND AIR FLOW   10 PERIODS
Sources of heat in mines, effects of heat and humidity, kata thermometer and hygrometer. Laws governing the airflow in mines, resistance of airways, Equivalent orifice, Natural ventilation, determination of NVP, direction of natural ventilation

MODULE-III: Mechanical ventilation   10 Periods
A: Principal types of mine fans, fan characteristic curves, mine characteristic curves, operating point, reversal of mine fans, Evasee and its importance.
B: Series and parallel operation of mine fans, booster fans, Face Ventilation. Overlap ventilation systems and controlled re-circulation

MODULE-IV: STANDARDS OF VENTILATION AND AIR DISTRIBUTION   09 PERIODS
Standards of ventilation including permissible air velocities, Ascensional, Descensional, Homotropal, Antitropal ventilation, Distribution of air, ventilation stoppings, Air crossings, Measurement of air velocities and pressure.

MODULE-V: VENTILATION PLANNING   09 PERIODS
Quantity and pressure requirement. Ventilation layout for coal mining and metal mining. Calculation of air quantity and total mine head required for ventilating a mine. Introduction to Network analysis: Hardy-Cross method, Ventilation survey.

TEXT BOOKS:

1. Mine Environment and Ventilation – G.B. Misra, Oxford University Press
2. Mine Ventilation and Air Condition – HL Hearlman, Wiley India (p) ltd

REFERENCES:
1. Environmental Engineering in Mines, Vatukuri V.S. & Lama R.D, Cambridge University Press.
2. Mining and Environment, Dhar B.B, APH Publishing.

E RESOURCES:

1.http://technology.infomine.com/reviews/ventilation/welcome.asp?view=full

2.https://link.springer.com/article/10.1134/S1062739116041178

COURSE OUTCOMES:

At the end of the course, students will be able to

1: Understand origin, physical and chemical properties of mine gases and their physiological effects

2: Understand Heat, Humidity and Air flow in mines

3: Understand Principal types of mine fans, Series and parallel operation of mine fans

4. Understand Standards of ventilation and Air distribution

5. Understand Ventilation Planning and Network analysis.

COS	\multicolumn{11}{c}{Programme Outcomes (POs)}											PSOS		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	2					1				2	2	2	2
CO2	3	2	2				2		2			2	3	2	2
CO3	3	2	2				2					2	3	3	2
CO4	3	1	2		1		2		2			1	3	1	2
CO5	3	1	2				1		1			2	3	1	2

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)		B.Tech. IV Semester	
Code: C2506	**DRILLING AND BLASTING**	L	T	P
Credits: 3		3	-	-

Prerequisite: Development of Mineral Deposits.

COURSE OBJECTIVES:

To understand the principles and mechanism of different drilling methods, novel drilling techniques. To learn the basic mechanism of rock fragmentation by blasting. To know the various types of explosives and accessories used in blasting. To learn the different methods of blasting adopted in surface and underground coal / non-coal mines including adverse effects of blasting & their control

MODULE-I: Principles of Drilling and Drill bits   10Periods

Principles of drilling: Principles of rock drilling, drillability, factors affecting the drillability, selection of drills, Core Drilling and recovery.

Drill Bits: Various types of drill bits, study of bit life, factors affecting bit life, Thrust and rotation

MODULE-II: EXPLOSIVES   10 PERIODS

Historical development, properties of explosives, low and high explosives, ANFO, slurries, Emulsion explosives, heavy ANFO, permitted explosives, testing of permitted explosives, bulk explosive systems-PMS, SMS & SME, substitutes for explosives and their applications- hydrox, cardox, airdox.

MODULE-III: FIRING OF EXPLOSIVES AND BLASTING METHODS   10 PERIODS

A: Firing of Explosives: Safety fuse, detonating cord and accessories, detonators, Exploders, Electric firing and non-electric firing, electronic detonators, NONEL blasting.

B: Blasting methods: Preparation of charge, stemming and shot firing, choice and economical use of explosives, misfires, blown out shots, incomplete detonation, their causes, prevention and remedies, Firing Patterns and Laws pertaining to blasting.

MODULE-IV: HANDLING OF EXPLOSIVES   05 PERIODS

Surface and underground transport of explosives, storage and handling of explosives, magazines, accidents due to explosives, precautions and safety measures during transportation and Legal Provisions.

MODULE-V: Mechanics of blasting and effects of blasting   13 Periods

Mechanics of blasting: Factors affecting rock breakage using explosives, theory of shaped charge, detonation pressure, coupling, shock waves impedance, critical diameter and rock fragmentation & analysis.

Effects of blasting: Vibrations due to blasting and damage criteria, fly rocks, dust, fumes, water pollution, controlled blasting and software's related to blasting.

TEXT BOOKS:

1. Blasting in ground excavations and mines, Roy Pijush Pal, Oxford and IBH, 1st ed 1993
2. Drilling technology handbook, C.P. Chugh, Oxford and IBH, 1st ed, 1977 .

REFERENCES:

1. Rock blasting effect and operation, Roy Pijush Pal, A.A. Balkema, 1st ed, 2005
2. Elements of mining technology, Vol-1, D.J. Deshmukh
3. Blasting operations, B.Hemphill Gary, Mc-graw Hill, 1st ed 1981
4. Explosive and blasting practices in mines, S.K.Das, Lovely prakashan, 1st ed, 1993.

E RESOURCES:

1. http://technology.infomine.com/reviews/blasting/welcome.asp?view=full
2. https://miningandblasting.wordpress.com/list-of-technical-papers/
3. Science direct

   COURSE OUTCOMES:

   At the end of the course, students will be able to

   1: Understand Principles of drilling and various types of drill bits.

   2: Understand different types of Explosives.

   3: Apply different methods of Blasting according to the conditions.

   4: Deal with the Explosives.

   5: Understand Mechanics of blasting and effects of blasting

COS	CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
	Programme Outcomes(POs)												PSOS		
	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2					1				2	2	2	2
CO2	3	2	2				2		1			2	3	2	2
CO3	3	2	2				1					2	3	3	2
CO4	3	1	2				2		2			1	3	1	2
CO5	3	1	2						1			2	3	1	2

Prerequisite: Engineering Mechanics, Mechanical Technology,

COURSE OBJECTIVES:
To understand the electrical layouts and power distribution in mine. To study the rope haulage layouts, technical details and applications. To study the various modes of transport means and electrical circuits. To study the types of pumps, installations and design calculations.

MODULE-I: INTRODUCTION   10 PERIODS
Different types of motive power used in mines – their field of application, relative merits and demerits; transmission and distribution of compressed air in mines, compressed air in mines, compressed air drills. Elements of the transport system, classification and techno- economic indices. Wire ropes – classification, construction, fields of application, rope capping and splicing; deterioration of rope in use and its prevention; testing of ropes, selection and maintenance, rope calculations.

MODULE-II: ROPE HAULAGE   10 PERIODS
Construction of the wire ropes, rope haulages–gravity, direct, balanced direct, main & tail, endless, reversible endless. Suitability of these haulages and their limitations. Dimension of ropes, drums and pulleys, care and maintenance of ropes, changing of haulage ropes, rope splicing, safety appliances in haulage road, and signaling, statutory requirements of haulages.

MODULE-III: Other transport systems   10 Periods
A: Locomotives – diesel, trolley-wire, battery locomotives, constructional features and safety devices and comparison of different types; underground and surface battery charging stations and safety measures, locomotive calculations;
B: Shuttle cars, underground trucks, load-haul- dumpers, SDL, aerial rope ways, gravity transport, principles of hydraulic& pneumatic transportation and their fields of application, electric layouts, man-riding systems.

MODULE-IV: PUMPING & CONVEYING   09 PERIODS
Different types of drives, installation and maintenance of pumps and pipes in shafts and roadways, electrical layouts, various sources of water in mines, design of sumps. Face haulage and conveyors – Various types of conveyors, Scraper chain conveyors, AFCs, belt conveyors, cable belt conveyor, shaking and vibrating conveyors, armoured

flexible conveyors, high angle conveying, electrical layouts. Numerical

problems in conveyors.

MODULE-V:Mine electrical engineering   **09Periods**

Distribution of electric power in mines, types of mine cables and their fields of applications, mining switch gears and their installation in hazardous atmosphere, flame proof enclosures, intrinsically safe circuits, (examples) safety aspects and signaling. Mine telephone system and latest development in mine communications.

TEXT BOOKS:
1. Elements of Mining Technology Vol. III, D.J. Deshmukh, Denett & Company,
2. Mine Transport – N.T. Karelin, Orient Longmans,

REFERENCES:
1. Mining and Transport – S. C. Walker, Elsevier
2. Introduction to Mining Engineers – Hartman. H.L, John Wiley & Sons.

E RESOURCES:
1. http://www.westrac.com.au/Industries/Pages/M ining.aspx
2.http://www.springer.com/in/book/9783319477909

COURSE OUTCOMES:

At the end of the course, students will be able to

1: Understand Different types of motive power used in mines and

different types of wire ropes and their applications

2: Understand different types of rope haulages

3: Understand diesel, trolley-wire, battery locomotives and machinery used in underground workings

4: Understand different types of pumps and belt conveyor

5: Understand how electricity will be supplied in mines.

COS	CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2					1				3	2	2	2
CO2	3	2	2				2		1			2	3	2	2
CO3	3	2	2				1					2	3	3	2
CO4	3	1	2				2		2			1	3	1	2
CO5	3	2	2						1			2	3	1	2

Course Objectives:

Student will be able to learn and understand the various basic concept and principles of properties of materials like young's modulus and rigidity modulus.

LIST OF EXPERIMENTS:

1. Compression test by using UTM
2. Tensile test by using UTM
3. Bending test on simply supported beam
4. Bending test on cantilever beam
5. Torsion test
6. Hardness test usingBrinnel hardness tester
7. Hardness test using Rockwell hardness tester
8. Test on springs a) compression spring b) tension spring
9. Impact test using Izod
10. Impact test using Charpy
11. Fatigue test
12. Hoop stress and strain relationship for the Thin Cylinder

COURSE OUTCOMES:

At the end of the course, students will be able to

1. Find out the hardness of different engineering materials.
2. Find out the Young's modulus of materials using deflection of beams
3. Determine the toughness of materials using Charpy and Izod test.
4. Understand the working principle of heavy machines like UTM, Hardness testers
5. Find out the Rigidity modulus of shafts using torsion test.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COS	**Programme Outcomes(POs)**												**PSOS**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2					1				3	2	2	2
CO2	3	2	2				2		1			2	3	2	2
CO3	3	2	2		1		1					2	3	3	2
CO4	3	1	2				2		2			1	3	1	2
CO5	3	2	2						1			2	3	1	2

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B. Tech IV Semester		
Code: C2508	**MINING GEOLOGY LAB**	**L**	**T**	**P**
Credits: 1		-	-	2

OBJECTIVES:

To identify minerals, rocks, ores and geological structures. To learn geological mapping, remote sensing techniques and geophysical methods

LIST OF EXPERIMENTS:

1. Identification and physical properties of impartment rock-forming minerals.
2. Identification and physical properties of ore-forming minerals.
3. Identification and distinguish characteristics of important igneous.
4. Identification and of sedimentary and metamorphic rocks.
5. Determination of srike and dip of planar features by clinometer compass.
6. Study of models pertaining to folds, faults and unconformities.
7. Study and interpretation of Topographic Maps.
8. Study of Geological Maps of Andhra Pradesh & India.
9. Study of Geomorphologic Map of India and Tectonic Map of India.
10. Study of Seismotectonic Atlas of India.
11. Vertical Electrical sounding Survey to determine depth to water table & bed rock.
12. Determination of unconfined compressive strength of important rock

Course Outcomes: At the end of the course, students will be able to:

1: Identify the properties of rock forming and ore forming minerals.
2: Determine the strike and dip planar features by clinometer compass. Mine Surveying
3: Identify the folds, faults and unconformities.
4: Knowledge of geology mapping.
5: Determine the unconfined compressive strength of important rocks.

CO- PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOS**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2					1				3	2	2	2
CO2	3	2	2				2		1			2	3	2	1
CO3	3	2	2		1		1					2	2	3	2
CO4	3	1	2		2	2	2		2			1	3	2	2
CO5	3	2	2			3			2			2	3	1	2

2022-23 Onwards (MR-22)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code: C0562	**Object Oriented Programming Lab** (Common for CE, EEE, ME, ECE, MiE)	**L**	**T**	**P**
Credits: 1		-	1	2

Prerequisites: NIL

Course Objectives:
This course will make students able to learn and understand the concepts and features of object-oriented programming and the object-oriented concept like inheritance and will know how to make use of interfaces and package, to acquire the knowledge in Java's exception handling mechanism, multithreading.

Software Requirements: Java

List of Programs:
1. Write a Java Program to implement
a) Default Constructor
b) Parameterized constructor

2. Write a Java Program to implement
a) Method overloading
b) Constructor overloading

3. Write a Java program to implement
a) Single Inheritance
b) Multilevel Inheritance
c) Hierarchical Inheritance

4. Write Java programs that uses the following keywords… a) this
c) super

5. Write Java programs that uses the following keywords…
a) static
b) final

6. Write a Java program to implement
a) Method overriding.
b) Dynamic method dispatch.

7. Write a Java program to implement
a) abstract method
b) Interfaces

8. Write a Java program to create user defined packages.

9. Write a Java program to implement Exception Handling using
   a) try-catch clause
   b) Multiple Catch clauses
      d) Nested try blocks

10. Write a Java program that
    a) create user defined Thread by extending Thread class.
    b) create user defined Thread by implementing Runnable Interface
    c) create two user defined Threads i.e., Multi-Threading using Thread

11. Write a Java program
    a)   checks whether a given string is a palindrome or not.
    b)   for sorting a given list of names in ascending order.
         c)   reads a line if integers and then displays each integer and the sum of all integers (use string tokenizer class of java.util).

12. Write a Java program that
    a)   reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
    b)   reads a file and displays the file on the screen, with a line number before each line.

TEXT BOOKS:
   1. Herbert Schildt, "**Java The complete reference**", TMH, 8th edition, 2011.
   2. T. Budd, "**Understanding OOP with Java**", Pearson Education, updated edition, 1998.

REFERENCES:
   1. P.J. Deitel and H.M. Deitel, "**Java for Programmers**", Pearson education.
   2. P. Radha Krishna, "**Object Oriented Programming through Java**", Universities Press.
   3. Bruce Eckel," **Programming in Java**", Pearson Education.
   4. S. Malhotra and S. Choudhary," **Programming in Java**", Oxford Univ. Press.

Course Outcomes:
       At the end of the course, students will be able to
   1. Differentiate structured programming and object-oriented programming and know the concepts of classes, objects, members of a class.
   2. Apply object-oriented programming features and concepts for solving given problems using inheritance and will know how to organize files in packages and concept of interface.
   3. Capable of handling run time errors using Exceptional Handling and exploring strings.
   4. Develop applications for concurrent processing using Thread Concept.
   5. Capable of handling IO operations using Files.

<table>
<tr><td colspan="17">**CO- PO, PSO Mapping**
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<tr><td rowspan="2">**COs**</td><td colspan="12">**ProgrammeOutcomes(POs)**</td><td colspan="3">**PSOs**</td></tr>
<tr><td>**PO1**</td><td>**PO2**</td><td>**PO3**</td><td>**PO4**</td><td>**PO5**</td><td>**PO6**</td><td>**PO7**</td><td>**PO8**</td><td>**PO9**</td><td>**PO10**</td><td>**PO11**</td><td>**PO12**</td><td>**PSO1**</td><td>**PSO2**</td><td>**PSO3**</td></tr>
<tr><td>**CO1**</td><td></td><td>2</td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>3</td><td>2</td><td></td></tr>
<tr><td>**CO2**</td><td></td><td></td><td>3</td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td>3</td><td></td></tr>
<tr><td>**CO3**</td><td></td><td>2</td><td>2</td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td></tr>
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CO4			3		3								2	
CO5		2	2		3							2	2	

2022-23 Onwards (MR-22)	**MALLA REDDY ENGINEERING COLLEGE** (Autonomous)	**B. Tech. IV Semester**		
Code: C00M1 **Credits: Nil**	**GENDER SENSITIZATION** **(Common for CE, ME and Min.E)**	**L**	**T**	**P**
		2	**-**	**-**

PREREQUISITE: NIL COURSE OBJECTIVES:

To develop students' sensibility with regard to issues of gender in contemporary India. To provide a critical perspective on the socialization of men and women. To introduce students to information about some key biological aspects of genders. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence. To expose students to more egalitarian interactions between men and women.

MODULE -I: - UNDERSTANDING GENDER   06 PERIODS

Gender: Why Should We Study It? *(Towards a World of Equals:* Unit -1) Socialization: Making Women, Making Men *(Towards a World of Equals:* Unit -2) Introduction. Preparing for Womanhood. Growing up Male. First Lessons in Caste. Different Masculinities.

Just Relationships: Being Together as Equals (*Towards a* World *of Equals:* Unit *-2)* Mary iKorn and Onler. Love and Acid just do not Mix. Love Letters. Mothers ani Fathers. Further Reading: Rosa Parks-The Brave Heart.

MODULE -II: - GENDER AND BIOLOGY   06 PERIODS

Missing Women: Sex Selection and Its Consequences *(Towards a World of Equals:* Unit -4)
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary *(Towards* a *World of Equals:* Unit -10)
Two or Many? Struggles with Discrimination.
Additional Reading: Our Bodies, Our Health *(Towards a World of Equals:* Unit -13)

MODULE -III: - GENDER AND LABOUR   07 PERIODS

A: Housework: The Invisible Labour *(Towards a World* of *Equals:* Unit
-3) "My Mother doesn't Work." "Share the I.oad."
B: Women's Work: Its Politics and Economics *(Towards a World of*
Equals: Unit -7) Fact and Fiction. Unrecognized and Unaccounted work.
Further Reading: Wages and Conditions of Work.

MODULE -IV: - ISSUES OF VIOLENCE   07 PERIODS

Sexual Harassment: Say Nol *(Towards a World of Equals:* Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading:
"Chdpulum. Domestic Violence: Speaking Out *(Towards a World of Equals:* Unit -5)
Is Home a Safe Place? When Women Unite (Film" Rebuilding Lives. Further Reading: New Forums for Justice. Thinking about Sexual Violence *(Towards a World of Equals:* Unit -11)

Blaming the Victim-1 Fought for my Life... " - Further Reading: The Caste Face of Violence.

MODULE -V:- GENDERSTUDIES   **06 PERIODS**

Knowledge: Through the Lens of Gender *(Towards a Work/ of Equals:* Unit -5)

Point of View. Gender and the Structure of Knowledge. Further Reading: Unacknowledged Women Artists of Telangana.

Whose History? Questions for Historians and Others *(Towards a World of Equals:* Unit -9) Reclaiming a Past. Writing other Histories. Further Reading: Missing Pages from Modern Telangana History.

Essential Reading: All the Units In the Textbook, *"Towards a World of Equals: A Bilingual Textbook on Gender"* written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Mina Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Thant

Note: Since it Is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field.

TEXT BOOKS: -
  1. Towards a World of Equals: A bilingual Textbook on Gender , A Suneetha -etall

REFERENCES: -
  1. Sen, Amartya. "More than One Million Women are Missing.' New York Review of Books 37.20 (20 December 1990). Print. We *Were Making History ' Life Stories of Women in theToIrmgana People's Struggle.* New Delhi: Kali for Women, 1989.
  2. Tripti Lahiri. "By the Numbers: Where Indian Women Work." Women's Studios Journal (14 November 2012) Available online at: http:// blogs.visj.com/ India real time/2012/11/14/by -the-numbers-where-Indan-womenworkP
  3. K. Satyanarayana and Susie Thant (Ed.) Steel Nibs Are Sprouting: New Dalit Writing From South India, Dossier 2: Telugu And Kannada htto://harooreollins.co.in/BookDetailasp?Flook Cndet,3732
  4. Vimata. "Vantillu (The Kitchen)". Women Writing in India: 600 BC to the Present. Volume II: The 20th Century. Ed. Susie Thaw and K. Lalita. Delhi: Oxford University Press 1995. 599-601.
  5. Shatrughna, Veena et al. Women's Work and its Impact on Child Health end Nutrition, Hyderabad, National Institute of Nutrition, Indian Council of Medical Research. 1993.
  6. Stree Shakti Sanghatana. 'We Were Making I listory ' Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women, 1989.

E - Resources:
  • http://www.actforyouth.net/resources/rf/rf_gender1_1213.cfm(UNDERSTANDING GENDER)
  • https://www.simplypsychology.org/gender-biology.html(GENDERAND BIOLOGY)
  • http://www.yourarticlelibrary.com/essay/essay-on-gender-issues-in-labour-market-in-india/40442/ (GENDER AND LABOUR)
    Journals/Magazines links:-
  • http://journals.sagepub.com/doi/abs/10.1177/1077801200006007004 (ISSUES OF VIOLENCE)
  • http://www.nordiclabourjournal.org/emner/likestilling (GENDER AND BIOLOGY)

Course Outcomes:

After completion of the course, students will be able to:
1. Develop a better understanding of important issues related to gender in contemporary India.
2. Sensitize about the basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Acquire insight into the gendered division of labour and its relation to politics and economics.
5. Develop a sense of appreciation of women in all walks of life.

<table>
<tr><td colspan="16" align="center">CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
<tr><td rowspan="2">COs</td><td colspan="12">Programme Outcomes(POs)</td><td colspan="3">PSOs</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>PO9</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td><td>PSO3</td></tr>
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