ACADEMIC REGULATIONS COURSE STRUCTURE

AND

DETAILED SYLLABUS

DEPARTMENT

OF

MECHANICAL ENGINEERING

(Applicable for batches admitted from 2023-2024)

VVIT

VASIREDDY VENKATADRI
INSTITUTE OF TECHNOLOGY

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

(Autonomous)

Approved by AICTE, Permanently Affiliated to JNTUK,

NAAC Accredited with 'A' Grade, ISO 9001:2015 Certified

Nambur (V), Pedakakani (M), Guntur (Dt.), Andhra Pradesh – 522 508

ACADEMIC REGULATIONS (R23) FOR B. TECH (REGULAR/HONORS/MINOR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2023-24 onwards

The B.Tech Degree of Jawaharlal Nehru Technological University Kakinada, Kakinada 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 impart quality education through exploration and experimentation and generate socially conscious engineers, embedding ethics and values, for the advancement in science and technology.

MISSION

- To educate students with a practical approach to dovetail them to industry-needs.
- To govern the institution with a proactive and professional management with passionate teaching faculty.
- To provide holistic and integrated education and achieve overall development of students by imparting scientific and technical, social and cognitive, managerial and organizational skills.
- To compete with the best and be the most preferred institution of the studious and the scholarly.
- To forge strong relationships and linkage with the industry.

OBJECTIVES

- Equip the institute with state-of-the-art infrastructure comparable to the best in the industry.
- Tap the resources of the best minds in the field as faculty and visiting faculty.
- Groom students to become global entrepreneurs and responsible citizens.
- Provide financial assistance to meritorious students.
- Requisition the services of the best HR managers to place our students in reputed industries.
- Provide conducive atmosphere to the faculty for Research & Development and ensure active participation of the students.

About MEC Department

- The Mechanical engineering is one of the core engineering departments, which has potential to accommodate all efficient engineers. The Mechanical engineers serve all other branches of engineering directly or indirectly. The Mechanical engineers can find their place in Automobile engineering sector, Electrical Engineering sector, IT sector, manufacturing industries, design industries, Military, Naval and Air force, defence research organizations, material research organizations etc. The Mechanical Engineering department of the college has been established in the year 2011 with an intake of 60 students. In the following year the intake of the department was increased to 120 which is increased to 180 by the academic year 2018-19.

- The department has fourteen well equipped laboratories and 31 highly qualified and experienced teaching faculty members. There are five professors, four associate professors and the rest are assistant professors. Six faculty members are doctorates. The remaining faculty members are all M. Tech degree holders and seven of them are pursuing Ph.D. Many of the faculty members have publications in reputed International and National journals.

Department Vision

- To impart the knowledge of mechanical engineering with global perspectives for graduates to serve the industry in particular and the society at large through quality education and research.

Department Mission

- To enable graduates to be technically strong, ethically sound with good communication skills by innovative teaching methods
- To provide world class education to mould the students, so that they possess good leadership qualities and professional skills.
- To create a conducive environment and facilities to improve overall personality development of the students.
- To create an awareness of the social responsibilities of an engineer.
- To bond strong relationship with industries to upgrade the knowledge of the students through exposure for cutting edge technologies.

1. Award of the Degree

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

(i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).

(ii) Registers for 160 credits and secures all 160 credits.

(b) Award of B.Tech. degree with Honors

A student will be declared eligible for the award of the B.Tech. with Honors if he/she fulfils the following:

(i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.

(ii) Registering for Honors is optional.

(iii) Honors is to be completed simultaneously with B.Tech. Programme.

2. Students who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 (a)(i).

3. Admissions

Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government / University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination

conducted by the A.P. Government / University or any other order of merit approved by the A.P. Government / University, subject to reservations as prescribed by the Government/University from time to time.

4. Program related terms

Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hrs. Practical (Lab) per week	1 credit

a) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.

b) **Choice Based Credit System (CBCS):** The CBCS provides a choice for students to select from the prescribed courses.

5. Semester/Credits:

i) A semester comprises 90 working days and an academic year is divided into two semesters.

ii) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.

iii) Regular courses may also be offered during the summer on a fast-track mode to enable students to do additional courses or complete backlogs in coursework.

iv) The Universities/HEIs can decide on the courses to be offered in the summer term depending on the availability of faculty and the number of students.

6. Structure of the Undergraduate Programme

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total credits	AICTE Recommendation (%)
1.	Humanities and Social Science including Management (HM)	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21 %	19 - 23%
6.	Internships & Project work (PR)	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-credit	Non-credit	-

7. Course Classification

All subjects/ courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programmes) are broadly classified as follows:

S.No.	Broad Course Classification	Course Category	Description
1.	Foundation Core Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences, and management courses
2.	Core Courses	Professional Core Courses (PC)	Includes subjects related to the discipline / department / branch of Engineering
3.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline / department / branch of Engineering

		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the parent discipline / department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	Interdisciplinary/job-oriented/domain courses which are relevant to the industry
4.	Project &Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

8. Programme Pattern

i. The total duration of the B. Tech (Regular) Programme is four academic years.

ii. Each academic year of study is divided into two semesters.

iii. The minimum number of instruction days in each semester is 90 days.

iv. There shall be a mandatory student induction program for freshers, with a three-week duration before the commencement of the first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.

v. Health/wellness/yoga/sports and NSS /NSS /Scouts & Guides / **Community service activities** are made **mandatory as credit courses** for all the undergraduate students.

vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.

vii. Design Thinking for Innovation & Tinkering Labs is made mandatory as credit courses for all the undergraduate students.

viii. Increased flexibility for students through an increase in the elective

component of the curriculum, with **05 Professional Elective** courses and **04 Open Elective** courses.

ix. Professional Elective Courses include the elective courses relevant to the chosen specialization/branch. Proper choice of **professional elective courses** can lead to students specializing in **emerging areas** within the chosen field of study.

x. A total of **04 Open Electives** are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a **Minor within the 160 credits** by opting for the courses offered through various verticals/tracks under Open Electives.

xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.

xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be **05 skill-oriented** courses offered during **III to VII semesters**. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain / interdisciplinary courses and the other shall be a soft skills course.

xiii. Students shall undergo mandatory **summer internships**, for a minimum of **eight weeks duration** at the end of the **second and third year** of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.

xiv. There shall also be mandatory **full internship** in the **final semester** of the programme along with the **project work**.

xv. An undergraduate degree with **Honors** is introduced for the students having good academic record.

xvi. Each department shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

xvii. Each department shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/career growth / placements / opportunities for higher studies /GATE/other competitive exams etc.

xviii. Preferably **25% of course work** for the **theory courses** in **every semester** shall be conducted in the **blended mode** of learning.

9. Evaluation Process

The performance of a student in each semester shall be evaluated **subject-wise** with a maximum of **100 marks** for **theory** and **100 marks** for **practical subject**. **Summer Internships** shall be evaluated for **50 marks**, **Full Internship & Project work** in **final semester** shall be evaluated for **200 marks**, mandatory courses with no credits shall be evaluated for **30 mid semester marks**.

A student **must secure** not less than **35% of marks** in the **end examination** and a **minimum of 40% of marks** in the **sum of the mid semester and end examination marks** taken together for the theory, practical, design, drawing subject or project etc. In the case of a mandatory course, he/she should secure 40% of mid semester marks.

THEORY COUSES

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

i) For the theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.

ii) For practical subjects, the distribution shall be 30 marks for the Internal Evaluation and 70 marks for the End Examination.

iii) If any subject has both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given the same subject code with an extension of 'T' for theory subject and 'P' for practical subject.

a) Continuous Internal Evaluation

i) For theory subjects, during a semester, there shall be two mid-term examinations. The first midterm examination shall be conducted for the first two and half units of syllabus and the second midterm examination shall be conducted for the rest of the syllabus. Each **mid-term examination consists** of (i) one **online objective** examination (ii) one **descriptive** examination (iii) one **assignment** and (iv) one **Subject Seminar**.

The **online examination** (objective) shall be **10 marks** with duration of **20 minutes**, **descriptive examination** shall be for **10 marks** with a duration of **1 hour 30 minutes**, **assignment** test shall be **5 marks** with duration of **50 minutes** (Open book system with questions of L4 standard on Bloom's scale) and **Subject Seminar 5 marks**.

ii) The first **online** examination (objective) is set with **20 multiple choice questions for 10 marks** (20 questions x 1/2 marks) from first two and half units (50% of the syllabus).

iii) The first **descriptive examination** is set with **30 marks** (two questions for 12 marks and one question for 6 marks) with either or choice from first two and half units (50% of the syllabus), the student must answer all questions. The marks obtained in the subjective paper are condensed to 10 marks.

iv) The first **assignment Test** from first two and half units conducted for **20 Marks** and will be **scaled down to 5 Marks**. The test is an **open book** system, and the duration of the exam is **50 minutes**. Students can bring a maximum of three printed text books related to that subject. (Soft copies of the text books will not be allowed.) The assignments must provide broadened exposure to the course. The questions shall include problem solving approach, problem analysis & design, implementation, case studies etc.

v) For the first subject **seminar 5 marks**, each student shall be evaluated based on the presentation on any topic of his/her choice in the subject duly approved by the faculty member concerned.

In the **similar lines**, the **second mid** examinations shall be conducted on the rest of the syllabus. Any fraction in the total of mid marks shall be rounded off to the next higher mark.

vi) Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid	: 25
Marks obtained in second mid	: 20
Final mid semester Marks	: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination

and zero to the other.

For Example:

Marks obtained in first mid	: Absent
Marks obtained in second mid	: 25
Final mid semester Marks	: (0x0.2) + (25x0.8) = 20

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

i) There shall be **6 questions** and **all questions** are **compulsory**.

ii) **Question 1** shall contain **10 compulsory short answer questions** (2 short questions from each unit) for a total of **20 marks** such that **each question** carries **2 marks**.

iii) In each of the questions from **2 to 6**, there shall be **either/or type** questions of **10 marks each**. Students shall answer any one of them.

iv) The questions from **2 to 6** shall be set by covering one unit of the syllabus for each question.

Note: End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical &Electronics Engineering shall have the following pattern: **Question 1** shall contain **10 compulsory short answer questions** (Fist five Questions from first two and half units and last five questions from remaining syllabus). The questions numbers **2, 3, 4(a)** shall be set by covering from first two and half units and questions numbers **4(b), 5, 6** in the remaining syllabus.

PRACTICAL COURSES

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

a) For practical courses, there shall be a continuous evaluation during the semester for **30 internal marks** and the end examination shall be for **70 marks**.

b) **Day-to-day** work in the laboratory shall be evaluated for **15 marks** by the concerned laboratory teacher based on the regularity/record/viva and 15 marks for the internal test.

c) The end examination shall be evaluated for **70 marks**, conducted by the **concerned laboratory teacher** and a **senior expert** in the subject from the **same department**.

- Procedure: **20 marks**
- Experimental work & Results: **30 marks**
- Viva voce: **20 marks**.

d) For the subject having **design and/or drawing/graphics**, such as Engineering Drawing, the distribution of marks shall be **30 for mid semester** evaluation and **70 for end examination**.

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	100

Day-to-day work shall be evaluated for **15 marks** by the concerned subject teacher based on the reports/submissions prepared in the class. And there shall be **two midterm examinations** in a semester for duration of **2 hours** each for **15 marks** with weightage of **80% to better mid marks** and **20% for the other**. The first mid exam is set with **30 marks** (two questions for 12 marks and one question for 6 marks) with either or choice from first two and half units (50% of the syllabus), the student must answer all questions. The marks obtained in the subjective paper are condensed to 15 marks. The **second mid** examinations shall be conducted on the rest of the syllabus. Any fraction in the total of mid marks shall be rounded off to the next higher mark. Finalized mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

There shall be no objective paper in the mid semester examination. The sum of day-to-day evaluation and the mid semester marks will be the final internal marks for the subject.

Note: In a practical subject consisting of two parts (Eg: Basic Electrical & Electronics Engineering Lab), the **end examination** shall be conducted for **70 marks** as a **single laboratory** in **3 hours**. **Internal examination** shall be evaluated **30 marks** in **each part**. F**inal**

Internal marks shall be arrived by considering the **average of marks obtained in two parts**.

The **end examination pattern for design and/or drawing/graphics** shall consist of **5 questions, either/or type**, of **14 marks each**. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing, multiple branches, etc. is mentioned along with the syllabus.

e) There shall be **no external examination** for **mandatory courses** with **zero credits**. However, **attendance shall be considered** while calculating **aggregate attendance** and student shall be **declared to have passed** the mandatory course only when he/she secures a minimum of **40%** in the **internal examinations**. In case the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

f) The **laboratory records** and **mid semester test papers** shall be **preserved** for a **minimum of 3 years** in the **respective departments** as per the norms and shall be produced to the various committees as and when the same are asked for.

10. Skill oriented Courses

i) There shall be five skill-oriented courses offered during III to VII semesters.

ii) Out of the **five skill courses two** shall be skill-oriented courses from the **same domain**. Of the **remaining three** skill courses, **one shall** be a **soft skill course** and the **remaining two** shall be **skill-advanced courses** from the **same domain/Interdisciplinary/Job oriented**.

g) The course shall carry 100 marks and shall be evaluated through continuous assessments during the semester for 30 internal marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid semester test. The end examination similar to practical examination pattern shall be conducted by the concerned teacher and an expert in the subject nominated by the principal.

iii) The Head of the Department shall identify a faculty member as

coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks/grades shall be assigned to the students by the above committee based on their performance.

iv) The student shall be given an option to choose either the skill courses being offered by the department or to choose a certificate course being offered by industries/Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the department to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

v) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the Head of the department.

11. Massive Open Online Courses (MOOCs)

A Student must pursue and complete **one course compulsorily** through MOOCs approved by the concerned department. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through **MOOCs for awarding the degree**. A student is **not permitted to register and pursue core courses** through MOOCs.

A student shall register for the course (**Minimum of either 8 weeks or 12 weeks**) offered through MOOCs with the **approval of Head of the Department**. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to **earn a certificate** by **passing the exam**. The student shall be **awarded the credits assigned** in the **curriculum** only by **submission of the certificate**. The **examination fee**, if any, **will be borne by the student**. Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for **credit transfer as specified** and **are exempted from appearing internal as well as external examination** (for the specified equivalent credit course only)

conducted by the college.

Necessary amendments to the **rules and regulations** regarding adoption of **MOOC courses** would be proposed from time to time.

12. Credit Transfer Policy

Adoption of **MOOCs is mandatory**, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the University shall allow up to a maximum of **20% of the total courses** being offered in a particular programme i.e., maximum of **32 credits** through **MOOCs platform**.

i) The **college shall** offer credit mobility for MOOCs and give the **equivalent credit weightage to the students for the credits** earned through online learning courses.

ii) Student registration for the **MOOCs shall be** only through the **respective departments** and it is **mandatory** for the student to share **necessary information** with the **department**.

iii) The **credit transfer** policy will be **applicable** to the **Professional & Open Elective** courses only.

iv) The **concerned department** shall **identify** the courses permitted for **credit transfer**.

v) The **department shall notify** at the **beginning of semester** the **list** of the online learning courses **eligible for credit transfer**.

vi) The department shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

vii) The department shall ensure **no overlap of MOOC exams** with that of the **college examination schedule**. In case of **delay in results**, the college will **re-issue** the **marks sheet** for **such students**.

viii) Students **pursuing courses under MOOCs** shall acquire the required credits only after **successful completion** of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.

ix) The **institution** shall **submit** the following to the **examination section of the university**:

- List of students **who have passed MOOC** courses in the **current**

semester along with the **certificate of completion**.

- **Undertaking form** filled in by the students **for credit transfer**.

x) The universities shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the University from time to time.

13. Academic Bank of Credits (ABC)

The institution has implemented Academic Bank of Credits (ABC) to promote flexibility in curriculum as per NEP 2020 to

i) provide option of mobility for learners across the universities of their choice
ii) provide option to gain the credits through MOOCs from approved digital platforms.
iii) facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC
iv) Execute Multiple Entry and Exit system with credit count, credit transfer and credit acceptance from students' account.

14. Mandatory Internships Summer Internships

Two summer internships either **onsite or virtual**, each with a **minimum** of **08 weeks** duration, done at the **end of second and third years**, respectively are mandatory. It shall be completed in collaboration with **local industries, Govt. Organizations, construction agencies, Power projects, software MNCs** or any industries in the areas of concerned specialization of the Undergraduate program. **One of the two summer internships** at the **end of second year** (**Community Service Project**) shall be **society oriented** and shall be completed in collaboration with government organizations/NGOs & others. The **other internship** at the **end of third year** is **Industry Internship** and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The **guidelines issued by the APSCHE / University** shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the

departmental committee. A student will be required to **submit** a summer internship **report** to the concerned department and appear for an **oral presentation** before the departmental committee comprising of Head of the Department, supervisor of the internship and a senior faculty member of the department. A certificate of successful completion from industry shall be included in the report. The **report and the oral presentation** shall **carry 50% weightage each**. It shall be evaluated for **50 external marks**. There shall be **no internal marks** for Summer Internship. A student shall secure a **minimum of 40%** of marks for successful completion. In case a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the institution.

Full Semester Internship and Project work:

In the **final semester**, the student should **mandatorily register** and undergo internship (**onsite/virtual**) and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship **completion certificate** and a **project report**. A student shall also be permitted to submit a project report on the work carried out during the internship.

The **project report** shall be **evaluated** by an **external examiner**. The total marks for project work are **200 marks** and distribution shall be **60 marks** for **internal** and **140 marks** for **external** evaluation. The **supervisor** assesses the student for **30 marks** (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental **Project Review Committee** consisting of supervisor, a senior faculty and HOD **for 30 marks**. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of an **internal examiner and external examiner** appointed by the University and is evaluated for **140 marks**.

The department shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

15. Guidelines for offering a Minor

To promote interdisciplinary knowledge among the students, the

students admitted into B.Tech. in a major stream/branch are eligible to obtain a degree in Minor in another stream.

i) The **Minor program** requires the completion of **12 credits** in Minor stream chosen.

ii) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should complete the compulsory courses (or equivalents) before registering for the electives.

iii) Electives (minimum of 2 courses) to complete a total of 12 credits.

Note: A total of **04 Open Electives** are offered in the curriculum. A student can complete the requirement for Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.

16. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additional specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is the best choice for academically excellent students having a good academic record and interest towards higher studies and research.

i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.

ii) A student shall earn an additional **15 credits** for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This **is in addition to the credits** essential for obtaining the Undergraduate degree in Major Discipline (i.e., **160** credits).

iii) A student is permitted to **register for Honors** in **IV semester after the results of III Semester** are declared and students may be allowed to take maximum two subjects per semester pertaining to the **Honors from V Semester onwards**.

iv) The Principal of the department shall arrange separate class work and timetable of the courses offered under Honors program.

v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may

not be counted towards the Honors.

vi) Students can complete the courses offered under **Honors either in the college** or in **online platforms** like SWAYAM with a **minimum duration** of **12 weeks for a 3-credit course and 8 weeks duration for a 2-credit** course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.

vii) The attendance for the registered courses under Honors and regular courses offered for Major degree in a semester are to be considered separately.

viii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending semester end examinations.

ix) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. **No class/division** (i.e., second class, first class and distinction, etc.) **shall be awarded for Honors degree programme**.

x) If a **student drops** or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a **separate grade sheet mentioning** the additional courses completed by them.

xi) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors

i) Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline

ii) The **enrolment** of students into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken **up to III semester** in case of regular entry students and **only III semester** in case of **lateral entry** students. Students having **7 CGPA without any backlog subjects** will be permitted to register for Honors.

iii) If a student is detained due to lack of attendance either in Major or in Honors, registration shall be cancelled.

iv) Transfer of credits from Honors to regular B. Tech degree and vice-

versa shall not be permitted.

v) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors

i) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register for the courses under Honors.

ii) The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of students pursuing the Honors.

iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from the parent department shall be assigned to a group of students to monitor the progress.

iv) There is no fee for registration of subjects for Honors program offered offline at the respective institutions.

17. Attendance Requirements:

i) A student shall be eligible to appear for the University external examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

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

iv) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.

v) If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

vi) If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

vii) For induction programme attendance shall be maintained as per AICTE norms.

18. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 17.

i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.

ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) up to in the subjects that have been studied up to III semester.

iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) in the subjects that have been studied up to V semester.

And in case a student is detained for want of credits for a particular academic year by ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V semester or VII semester respectively as the case may be.

iv) When a student is detained due to lack of credits/shortage of attendance he/she may be re-admitted when the semester is offered after fulfilment of academic regulations. In such a case, he/she shall be in the academic regulations into which he/she is readmitted.

19. Grading:

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the % marks in the subject fall	Grade	Grade points Assigned
90 & above	S (Superior)	10
80 - 89	A (Excellent)	9
70 - 79	B (Very Good)	8
60 - 69	C (Good)	7
50 - 59	D (Average)	6
40 - 49	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

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

$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$

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

The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.,

$CGPA = \Sigma (C_i \times S_i)/ \Sigma C_i$

where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits up to that semester.

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

While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured
First Class with distinction*	≥ 7.75 (Without any supplementary appearance)
First Class	≥ 7.75 (With any supplementary appearance) (or) ≥ 6.75 and < 7.75
Second Class	≥5.75 and <6.75
Pass Class	≥5 and <5.75
Fail	<5

***Note:** Students who have written supplementary examinations to fulfil the credit requirement will not be awarded First Class with Distinction. For such students the highest degree that is awarded will be First Class Only.

CGPA to Percentage conversion Formula – (CGPA – 0.5) x 10

20. With–holding of Results

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

21. Multiple Entry / Exit Option

(a) Exit Policy:

The students can choose to exit the four-year programme at the end of first/second/third year.

i) **UG Certificate in (Field of study/discipline)** - Programme duration:

First year (first two semesters) of the undergraduate programme, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

ii) **UG Diploma (in Field of study/discipline)** - Programme duration: First two years (first four semesters) of the undergraduate programme, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job-ready competencies required to enter the workforce.

iii) **Bachelor of Science (in Field of study/discipline)** i.e., **B.Sc. Engineering in (Field of study/discipline)**- Programme duration: First three years (first six semesters) of the undergraduate programme, 120 credits.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. programme will be provided in due course of time.

Note: The Universities shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

22. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The HoD of the respective department shall forward such proposals submitted by the students to the Principal. An evaluation committee constituted by the Principal shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not.

23. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission

as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section **2** and they will follow the academic regulations into which they are readmitted.

24. Minimum Instruction Days for a Semester:

The minimum instruction days including exams for each semester shall be 90 days.

25. Medium of Instruction:

The medium of instruction of the entire B. Tech undergraduate programme in Engineering &Technology (including examinations and project reports) will be in English only.

26. Student Transfers:

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

27. General Instructions:

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

b. Malpractices rules-nature and punishments are appended.

c. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.

d. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

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

f. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Vice-Chancellor / Head of the institution is final.

* * * *

ACADEMIC REGULATIONS (R23)
FOR B.TECH. (LATERAL ENTRY SCHEME)

*(Effective for the students getting admitted into II year through Lateral Entry Scheme from the Academic Year **2024-2025** onwards)*

1. Award of the Degree

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils th following:

(i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).

(ii) Registers for 120 credits and secures all 120 credits.

(b) **Award of B.Tech. degree with Honors**

A student will be declared eligible for the award of the B.Tech. with Honors if he/she fulfils the following:

(i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.

(ii) Registering for Honors is optional.

(iii) Honors is to be completed simultaneously with B.Tech. programme.

2. Students who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2

(i) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.

(ii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should be rounded off to lower digit) in the subjects that have been studied up to V semester.

And in case if student is already detained for want of credits for academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

(i) The entire course of study is three academic years on semester pattern.

(ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.

(iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

* * * *

MALPRACTICE RULES
DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

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

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

	around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including

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

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In case any emergency call Toll Free No. 1800 425 1288

LET US MAKE VVIT A RAGGING FREE CAMPUS

ABSOLUTELY NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

In case any emergency call Toll Free No. 1800 425 1288
LET US MAKE VVIT A RAGGING FREE CAMPUS

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MECHANICAL ENGINEERING

COURSE STRUCTURE AND SYLLABUS

B.TECH. - COURSE STRUCTURE – R23
(Applicable from the academic year 2023-24 onwards)

INDUCTION PROGRAMME

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch corresponding labs, tools, and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

I B.TECH - I SEMESTER

SN	Course Code	Subjects	L/D	T	P	Credits
1	BS&H	Communicative English	2	0	0	2
2	BS&H	Engineering Physics	3	0	0	3
3	BS&H	Linear Algebra & Calculus	3	0	0	3
4	ES	Basic Civil & Mechanical Engineering	3	0	0	3
5	ES	Introduction to Programming	3	0	0	3
6	BS&H	Communicative English Lab	0	0	2	1
7	BS&H	Engineering Physics Lab	0	0	2	1
8	ES	Engineering Workshop	0	0	3	1.5
9	ES	Computer Programming Lab	0	0	3	1.5
10	BS&H	Health and wellness, Yoga, and sports	0	0	1	0.5
11	LS	Life Skills-I	2	0	0	0
		Total Credits				**19.5**

I B.TECH - II SEMESTER

SN	Course Code	Subjects	L/D	T	P	Credits
1	BS&H	Engineering Chemistry	3	0	0	3
2	BS&H	Differential Equations & Vector Calculus	3	0	0	3
3	ES	Basic Electrical and Electronics Engineering	3	0	0	3
4	ES	Engineering Graphics	1	0	4	3
5	ES	IT Workshop	0	0	2	1
6	PC	Engineering Mechanics	3	0	0	3
7	BS&H	Engineering Chemistry Lab	0	0	2	1
8	ES	Electrical and Electronics Engineering Workshop	0	0	3	1.5
9	PC	Engineering Mechanics Lab	0	0	3	1.5
10	BS&H	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5
11	LS	Life Skills-II	2	0	0	0
		Total Credits				**20.5**

II B. TECH – I SEMESTER

S.No.	Category	Title	L	T	P	Credits
1	BS	Transforms and Numerical Methods	3	0	0	3
2	HSMC	Universal Human Values– Understanding Harmony & Ethical Human Conduct	2	1	0	3
3	Engineering Science	Thermodynamics	2	0	0	2
4	Professional Core	Mechanics of Solids	3	0	0	3
5	Professional Core	Material Science and Metallurgy	3	0	0	3
6	Professional Core	Mechanics of Solids and Materials Science Lab	0	0	3	1.5
7	Professional Core	Computer-aided Machine Drawing	0	0	3	1.5
8	Engineering Science	Python programming Lab	0	0	2	1
9	Skill Enhancement Course	Embedded Systems and IoT	0	1	2	2
10	Audit Course	Environmental Science	2	0	0	-
Total			**15**	**2**	**10**	**20**

II B. TECH – II SEMESTER

S.No.	Category	Title	L	T	P	Credits
1	Management Course- I	Industrial Management	2	0	0	2
2	Basic Science	Complex Variables, Probability and Statistics	3	0	0	3
3	Professional Core	Manufacturing processes	3	0	0	3
4	Professional Core	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	Professional Core	Theory of Machines	3	0	0	3
6	Professional Core	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	Professional Core	Manufacturing processes Lab	0	0	3	1.5

8	Skill Enhancement course	Theory of Machines Lab	0	1	2	2
9	Engineering Science	Design Thinking & Innovation	1	0	2	2
Total			**15**	**1**	**10**	**21**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation						

III B. TECH – I SEMESTER

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Machine Tools & Metrology	3	0	0	3
2	Professional Core	Thermal Engineering	3	0	0	3
3	Professional Core	Design of Machine Members	3	0	0	3
4	Professional Elective	**Professional Elective – I** **1. Refrigeration & Air-Conditioning** 2. Smart Materials 3. Industrial Robotics 4. Turbo Machines 5. 12 Week MOOC Swayam/ NPTEL Course recommended by BOS	3	0	0	3
5	Open Elective-I	1. Sustainable Energy Technologies 2. Applied Operations Research 3. Nano Technology 4. Thermal Management of Electronic systems 5. Entrepreneurship	3	0	0	3
6	Professional Core	Thermal Engineering Lab	0	0	3	1.5
7	Professional Core	Machine Tools & Metrology Lab	0	0	3	1.5
8	Skill Enhancement course	Soft Skills	0	1	2	2
9	Engineering Science	Tinkering Lab	0	0	2	1

10	Evaluation of Community Service Internship	Community Service Internship	-	-	-	2
Total			15	1	10	**23**

III B. TECH – II SEMESTER

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Heat Transfer	3	0	0	3
2	Professional Core	Artificial Intelligence and Machine Learning	3	0	0	3
3	Professional Core	Control systems	3	0	0	3
4	Professional Elective	**Professional Elective – II** 1. Finite Element Methods 2. Power Plant Engineering 3. Statistical Quality Control **4. Mechatronics** 5. 12 Week MOOC Swayam/ NPTEL Course recommended by BOS	3	0	0	3
5	Professional Elective	**Professional Elective – III** 1. Composite Materials 2. Hydrogen and Fuel Cell Technology **3. Design for Manufacturing** 4. Supply Chain Management 5. 12 Week MOOC Swayam/ NPTEL Course recommended by BOS	3	0	0	3
6	Open Elective - II	1.Introduction to Industrial Robotics 2. Work study and Industrial Ergonomics 3. Customer Relationship Management 4.Hybrid Vehicles	3	0	0	3

		5. Industrial Safety				
7	Professional Core	Heat Transfer Lab	0	0	3	1.5
8	Professional Core	Control systems Lab	0	0	3	1.5
9	Skill Enhancement course	Artificial Intelligence and Machine Learning Lab	0	1	2	2
10	Audit Course	Technical paper writing and IPR	2	0	0	-
Total			**20**	**1**	**08**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation						

IV B. TECH – I SEMESTER

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	CAD/CAM	2	0	0	2
2	Management Course- II		2	0	0	2
3	Professional Core	CAD/CAM Lab	0	0	2	1
4	Professional Elective	**Professional Elective – IV** 1. Renewable Energy Sources 2. Mechanical Vibrations 3. Automation in Manufacturing **4. Electric and Hybrid vehicles** 5. 12 Week MOOC Swayam/ NPTEL Course recommended by BOS	3	0	0	3
5	Professional Elective	**Professional Elective – V** 1. Condition Monitoring 2. Automobile Engineering **3. Smart Manufacturing** 4. Cryogenics 5. 12 Week MOOC Swayam/ NPTEL Course recommended by BOS	3	0	0	3
6	Open Elective -	1. 3D Printing	3	0	0	3

	III	Technologies 2. Introduction to Mechatronics 3. Robot programming 4. Product design and development 5. Digital Marketing Management				
7	Open Elective-IV	1. Optimization Techniques 2. Advanced Manufacturing Systems 3. Total Quality Management 4. Operations Management 5. Energy Auditing	3	0	0	3
8	Skill Enhancement Course	Geometric dimensioning and Tolerancing	0	1	2	2
9	Audit Course	Constitution of India	2	0	0	-
10	Internship	Evaluation of Industry Internship	-	-	-	2
Total			**18**	**1**	**04**	**21**

IV B. TECH – II SEMESTER

S.No.	Category	Title	L	T	P	Credits
1	PR	Internship and Project	**-**	**-**	**24**	**12**

I B.TECH	COMMUNICATIVE ENGLISH	L	T	P	C
I SEMESTER		2	0	0	2

Course Objectives:

- To facilitate effective listening, speaking, reading, and writing skills among the students.
- To enhance the LSRW skills in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary.
- To help the students to make them effective in speaking and writing skills and to make them industry ready.

Course Outcomes

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

CO1: Understand the context, topic, and pieces of specific information from social ortransactional dialogues.
CO2: Apply grammatical structures to formulate sentences and correct word forms.
CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions.
CO4: Evaluate reading / listening texts and to write summaries based on globalcomprehension of these texts.
CO5: Create a coherent paragraph, essay, and resume.

UNIT I
Lesson: HUMAN VALUES: Gift of Magi (Short Story)
Lesson: "How to Fashion Your Own Brand of Success" by Howard Whitman

Listening: Identifying the topic, the context, and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies, and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces ofinformation.
Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar: Parts of Speech, Basic Sentence Structures-forming questions
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: **NATURE: The Brook by Alfred Tennyson (Poem)**

Lesson: **"How to Conquer the Ten Most Common Causes of Failure" by Louis Binstock**

Listening: Answering a series of questions about main ideas and supporting ideas afterlistening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structuretalks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to linkthe ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

UNIT III

Lesson: **BIOGRAPHY: Elon Musk**

Lesson: **"How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz**

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations

UNIT IV

Lesson: **INSPIRATION: The Toys of Peace by Saki**

Lesson: **"How to Raise Your Self-Esteem and Develop Self-confidence" by James W Newman**

Listening: Making predictions while listening to conversations/transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes, or display complicated data.

Writing: Letter Writing: Official Letters, Resumes

Grammar: Reporting Verbs, Direct & Indirect Speech, Active & Passive Voice

Vocabulary: Words often Confused, Jargons

UNIT V

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Lesson: "How to Eliminate Your Bad Habits" by Benjamin Franklin

Listening: Identifying key terms, understanding concepts and answering a series ofrelevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts

Reading: Reading comprehension.

Writing: Writing structured essays on specific topics.

Grammar: Editing short texts identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

Text Books

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan 2023 (Units 1, 2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)
3. University of Success: OG Mandino Jaico Impression 2019 (5 Selected Lessons)

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020.
2. Bailey, Stephen. Academic Writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

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I B.TECH	ENGINEERING PHYSICS	L	T	P	C
I SEMESTER		3	0	0	3

Course Objectives:

- To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes:

CO1: Analyze the intensity variation of light due to polarization, interference and diffraction.
CO2: Familiarize with the basics of crystals and their structures.
CO3: Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.
CO4: Summarize various types of polarization of dielectrics and classify the magnetic materials.
CO5: Explain the basic concepts of Quantum Mechanics and the band theory of solids.
CO6: Identify the type of semiconductor using Hall effect.

UNIT-I: WAVE OPTICS

Interference: Introduction – principle of superposition – interference of light – interference in thin films (Reflection geometry) & applications – colours in thin films – Newton's Rings, determination of wavelength and refractive index.

Diffraction: Introduction – Fresnel and Fraunhofer diffractions – Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction grating - Dispersive power and resolving power of grating (Qualitative)

Polarization: Introduction -Types of polarization -Polarization by reflection, refraction, and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT-II: CRYSTALLOGRAPHY AND X-RAY DIFFRACTION

Crystallography: Space lattice, Basis, Unit Cell, and lattice parameters Bravais Lattices crystal systems (3D) coordination number packing fraction

of SC, BCC & FCC Miller indices separation between successive (hkl) planes.

X-ray diffraction: Bragg's law-X-ray Diffractometer–crystal structure determination by Laue's and powder methods

UNIT-III: DIELECTRIC AND MAGNETIC MATERIALS

Dielectric Materials: Introduction – dielectric polarization, dielectric polarizability, susceptibility, dielectric constant, and displacement vector – relation between the electric vectors – types of polarizations: electronic (Quantitative), ionic (Quantitative) and orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti's equation – complex dielectric constant – frequency dependence of polarization– dielectric loss.

Magnetic Materials: Introduction – magnetic dipole moment – magnetization – magnetic susceptibility and permeability – atomic origin of magnetism – classification of magnetic materials: Dia, para, ferro, anti-ferro & ferrimagnetic materials – domain concept for ferromagnetism & domain walls (Qualitative) – hysteresis – soft and hard magnetic materials.

UNIT – IV: QUANTUM MECHANICS AND FREE ELECTRON THEORY

Quantum Mechanics: Dual nature of matter – Heisenberg's uncertainty principle – significance and properties of wave function – Schrodinger's time independent and dependent wave equations – particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory-Fermi-Dirac distribution –Density of states -Fermi energy.

UNIT – V: SEMICONDUCTORS

Semiconductors: Formation of energy bands – classification of crystalline solids – Intrinsic semiconductors: Density of charge carriers – electrical conductivity – Fermi level – Extrinsic semiconductors: Density of charge carriers – dependence of Fermi energy on carrier concentration and temperature – drift and diffusion currents – Einstein's equation – Hall effect and its applications.

TEXT BOOKS

1. "Applied Physics" by T. Vijaya Krishna, T. Madhu Mohan, B. K. Pandey, Manoj K. Harbola, S. Chaturvedi - Cengage, 2020.
2. "A Text book of Engineering Physics" by M.N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
3. Engineering Physics -D. K. Bhattacharya and Poonam Tandon, Oxford press(2015)

REFERENCE BOOKS

1. Engineering Physics –Shatendra Sharma, Jyotsna Sharma, Pears on Education, 2018.
2. Engineering Physics"-Sanjay D.Jain, D.Sahasrabudhe and Girish, University Press.2010
3. Engineering Physics -M. R. Srinivasan, New Age international publishers (2009).
4. Fundamentals of Physics- Halliday, Resnick and Walker, Wiley (2006).
5. Physics for Scientists & Engineers, Serway and Jewett, Cengage (2019).

Web Resources: https://www.loc.gov/rr/scitech/selected-internet/physics.html

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I B.TECH	LINEAR ALGEBRA AND CALCULUS	L	T	P	C
I/II SEMESTER	(ALL BRANCHES)	3	0	0	3

Course Objectives:

- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

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

CO1: Develop and use of matrix algebra techniques that are needed by engineers for practical applications. (L6)
CO2: Determine the eigenvalues and eigenvectors of a matrix or a linear transformation and using them to diagonalize a matrix. (L5)
CO3: Utilize mean value theorems to real life problems. (L3)
CO4: Familiarize with functions of several variables which is useful in optimization. (L3)
CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates. (L3)

UNIT-I: MATRICES

Rank of a matrix by Echelon form and normal form - Cauchy- Binet formulae (without proof) - Inverse of non-singular matrices by Gauss-Jordan method - System of linear equations: Solving system of homogeneous and non-homogeneous equations - Gauss elimination method, Jacobi and Gauss-Seidel iteration methods.

UNIT-II: EIGENVALUES, EIGENVECTORS AND ORTHOGONAL TRANSFORMATION

Eigenvalues, Eigenvectors, and their properties - Diagonalization of a matrix - Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem - Quadratic form and nature of a quadratic form - Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT-III: CALCULUS

Mean Value Theorems (without proofs): Rolle's theorem, Lagrange's mean value theorem with their geometrical interpretation - Cauchy's mean value

theorem - Taylor's and Maclaurin's theorems with remainders - Problems and applications on the above theorems.

UNIT-IV: PARTIAL DIFFERENTIATION AND APPLICATIONS (MULTI VARIABLE CALCULUS)

Functions of several variables: Continuity and Differentiability - Partial derivatives - Total derivatives - Chain rule - Taylor's and Maclaurin's series expansion of functions of two variables - Jacobians - Functional dependence - Maxima and minima of functions of two variables - Method of Lagrange's multipliers.

UNIT-V: MULTIPLE INTEGRALS (MULTI VARIABLE CALCULUS)

Double integrals - Triple integrals - Change of order of integration - Change of variables to polar, cylindrical and spherical coordinates - Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9th edition. Higher Engineering Mathematics, H. K. Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021).

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I B.TECH	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
I SEMESTER		3	1	0	3

BASIC CIVIL ENGINEERING

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions and introduction to basic civil engineering materials and construction techniques.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance, and storage of water.

Course Outcomes:

On completion of the course, the student should be able to:

CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society and understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

CO2: Know the concepts of surveying and to understand the measurement of distances, angles, and levels through surveying.

CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation and importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.

UNIT I

BASICS OF CIVIL ENGINEERING: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-Technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials- Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT – II

SURVEYING: Objectives of Surveying- Horizontal Measurements- Angular Measurements-Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings - Contour mapping.

UNIT - IIIA

TRANSPORTATION ENGINEERING: Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbor, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology– Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Text Books

1. M. S. Palanichamy, Basic Civil Engineering, McGraw Hill Education, 4th edition, 2017
2. S. S. Bhavikatti, Basic Civil Engineering, New Age International, 2010
3. Srikrishna A. Dhale and Kiran M. Tajne, Basics of Civil Engineering, 2014.

Reference Books:

1. G. Shanmugam and M. S. Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education, 2018.
2. S. Gopi, Basic Civil Engineering, Pearson, 2018
3. Introduction to Civil Engineering, Course Material, IIT Madras.

BASIC MECHANICAL ENGINEERING

Course objectives:

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes: Upon successful completion of the course, the student will be able to

CO4: Understand the different manufacturing processes {**Understand level, KL2**}

CO5: Demonstrate the working of different mechanical power transmission systems and Basics of robotics. {**Understand level, KL2**}

CO6: Understand the working principles of Various power plants {**Understand level, KL2**}

UNIT-IIIB

INTRODUCTION TO MECHANICAL ENGINEERING: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

ENGINEERING MATERIALS: Classification of Engineering materials &Their applications: Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials. Definition of Strength, Hardness, Ductility and Toughness

UNIT-IV

MANUFACTURING PROCESSES: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

MECHANICAL POWER TRANSMISSION: Belt Drives, Chain, Rope drives, Gear Drives and their applications.

INTRODUCTION TO ROBOTICS: Joints & links, configurations, and applications of robotics

UNIT-V

POWER PLANTS: working principle of Steam, Diesel, Hydro, Nuclear power plants.

THERMAL ENGINEERING: working principle of Boilers (Cochran boiler, Babcock and Wilcox boiler, La Mont boiler), Refrigeration cycle (Ideal Vapour Compression refrigeration cycle) and air-conditioning system (Summer air-conditioning system), IC engines, Otto cycle, Diesel cycle, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Textbooks

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

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I B.TECH	INTRODUCTION TO PROGRAMMING COMMON TO ALL BRANCHES	L	T	P	C
I SEMESTER		3	0	0	3

Course Objectives:

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

Course Outcomes: A student after completion of the course will be able to

CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking.
CO2: Analyze a problem and develop an algorithm to solve it.
CO3: Implement various algorithms using the C programming language.
CO4: Understand more advanced features of C language.
CO5: Develop problem-solving skills and the ability to debug and optimize the code.

UNIT I INTRODUCTION TO PROGRAMMING AND PROBLEM SOLVING

Introduction: History of Computers, Basic organization of a computer: ALU, input-output units, memory.
Problem solving techniques: Algorithmic approach, characteristics of algorithm, Algorithms, flowcharts (Using Dia Tool).
Introduction to Programming: Languages & types, Basics of a Computer Program- basic structure of a C program, C Tokens – Literals, Primitive Data Types, Keywords, operators, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

UNIT II CONTROL STRUCTURES

Decision making: Simple sequential programs Conditional Statements (if, if-else, switch),
Iterative Statements: Loop - for, while, do-while, unconditional branching - break and continue.

UNIT III ARRAYS AND STRINGS

Arrays: indexing, memory model, programs with array of integers, two dimensional arrays
Strings: Introduction to Strings.

UNIT IV POINTERS & USER DEFINED DATA TYPES

Pointers: dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, Dynamic memory management.
User-defined data types: Structures and Unions.

UNIT V Functions & File Handling

Functions: Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables,

File Handling: Basics of File Handling

Textbooks:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

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I B.TECH	COMPUTER PROGRAMMING LAB	L	T	P	C
I SEMESTER	COMMON TO ALL BRANCHES	0	0	3	1.5

Course Objectives:

- The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

Course Outcomes:

CO1: Read, understand, and trace the execution of programs written in C language.

CO2: Select the right control structure for solving the problem.

CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.

CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

UNIT I

WEEK 1

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.

ii) Exposure to Turbo C, gcc

iii) Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

i) Sum and average of 3 numbers

ii) Conversion of Fahrenheit to Celsius and vice versa

iii) Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number

ii) Finding compound interest

iii) Area of a triangle using heron's formulae

iv) Distance travelled by an object

WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator' precedence and associativity

i) Evaluate the following expressions.

a. A+B*C+(D*E) + F*G
b. A/B*C-B+A*D/3
c. A+++B---A
d. J= (i++) + (++i)

ii) Find the maximum of three numbers using conditional operator

iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.

ii) Write a C program to generate electricity bill.

iii) Find the roots of the quadratic equation.

iv) Write a C program to simulate a calculator using switch case.

v) Write a C program to find the given year is a leap year or not.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and

for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop.

ii) Find the given number is a prime or not.

iii) Compute sine and cos series

iv) Checking a number palindrome

v) Construct a pyramid of numbers

WEEK 7:

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7:1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.

ii) Perform linear search on1D array.

iii) The reverse of a 1D integer array

iv) Find 2's complement of the given binary number.

v) Eliminate duplicate elements in an array.

WEEK 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

WEEK 9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v) Write a C program to implement realloc()

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10 : Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i) Create and display a singly linked list using self-referential structure.

ii) Demonstrate the differences between structures and unions using a C program.

iii) Write a C program to shift/rotate using bitfields.

iv) Write a C program to copy one structure variable to another structure of the same type

WEEK 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.

ii) Write a C function to find the length of a string.

iii) Write a C function to transpose of a matrix.

iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.

ii) Demonstrate Dangling pointer problem using a C program.

iii) Write a C program to copy one string into another using pointer.

iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers

WEEK14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

i) Write a C program to write and read text into a file.

ii) Write a C program to write and read text into a binary file using fread() and fwrite()

iii) Copy the contents of one file to another file.

iv) Write a C program to merge two files into the third file using command-line arguments.

v) Find no. of lines, words and characters in a file

vi) Write a C program to print last n characters of a given file.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.

2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice- Hall of India

2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

I B.TECH	COMMUNICATIVE ENGLISH LAB	L	T	P	C
I SEMESTER		0	0	2	1

Course Objectives:

- To expose the students to a variety of self-instructional, learner friendly modes of language learning.
- To train the students in basic communication skills and also make them ready to face job interviews.

Course Outcomes:

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills.
CO2: Apply communication skills through various language learning activities.
CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.
CO5: Create effective career objectives.

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover Letter, SOP
7. Group Discussions-Methods & Practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interview Skills

Suggested Software

- Walden Infotech
- Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press. 2018.
2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India, 2016.

3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed),Kindle, 2013

Web Resources:
Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

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I B.TECH	ENGINEERING PHYSICS LAB	L	T	P	C
I SEMESTER		0	0	2	1

Course Objectives:

- To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes: The students will be able to

CO1:Operate optical instruments like travelling microscope and spectrometer.
CO2: Estimate the wavelengths of different colours using diffraction grating.
CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.
CO4: Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
CO5: Calculate the band gap of a given semiconductor.
CO6: Identify the type of semiconductor using Hall effect.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photo electric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.

13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

References

- A Textbook of Practical Physics-S. Balasubramanian, M. N. Srinivasan, S. Chand Publishers, 2017.

Web Resources:

- www.vlab.co.in
- https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

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I B.TECH	ENGINEERING WORKSHOP	L	T	P	C
I SEMESTER		0	0	3	1.5

Course objectives:

- To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: Identify workshop tools and their operational capabilities (KL1)

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry, and welding (KL2)

CO3: Apply fitting operations in various applications (KL3)

CO4: Apply basic electrical engineering knowledge for House Wiring Practice (KL3)

List of Experiments:(Student has to complete Two experiments in each Trade)

1. **Demonstration:** Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
   a) Half – Lap joint
   b) Mortise and Tenon joint
   c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray
   b) Conical funnel
   c) Elbow pipe
   d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit
   b) Dovetail fit.
   c) Semi-circular fit
   d) Bicycle tire puncture and change of two-wheeler tyre

5. **Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series
   b) Two-way switch
   c) Godown lighting
   d) Tube light
   e) Three phase motor
   f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22

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I B.TECH	HEALTH AND WELLNESS, YOGA AND SPORTS	L	T	P	C
I SEMESTER		0	0	1	0.5

Course Objectives

- The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: After completion of the course the student will be able to

CO1: Understand the importance of yoga and sports for Physical fitness and sound health.
CO2: Demonstrate an understanding of health-related fitness components.
CO3: Compare and contrast various activities that help enhance their health.
CO4: Assess current personal fitness levels.
CO5: Develop Positive Personality

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index(BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas-Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
Practicing general and specific warm up, aerobics

ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T. K. V. Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J. Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc. 2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.

2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.

3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

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I B.TECH	LIFE SKILLS-I	L	T	P	C
I SEMESTER		2	0	0	0

Course Outcomes: After completion of the course the student will be able to

CO 1: To convert difficult data into equations and find solution by various methods and means using Algebra.
CO 2: Application of Number system usage in daily life.
CO 3: Enhance the logical abilities on various series and analogies (number, letter and verbal).
CO 4: Implementing logical classification, coding and decoding (number, letter and verbal).
CO 5: Understand importance of effective communication ski, usage of contextual vocabulary
CO 6: Understand the importance of grammar for effective communication.

The Life Skills course is divided into three components – Part-A. Quantitative Ability, Part-B. Reasoning Ability and Part-C. Verbal Ability.

Part-A: Quantitative Ability: Almost all competitive examinations test the candidate for quantitative aptitude, especially recruitment test, public service examinations management courses, where they evaluate the student's thinking prowess and analytical skills. Critical analysis of problems asked in examination reveal that they are designed to correlate multiple topics and the test taker is expected to identify those link points and come out with an out-of-box unique solution. The purpose of the test is to assess arithmetic abilities, logic, analysis, problem solving and decision-making skills.

Part-B: Reasoning Ability: Reasoning ability is the ability to draw connections between factors, and the ability to synthesize a message from a body of information. Reasoning ability of the aspirants for jobs or courses is tested by means of a verbal reasoning test non-verbal reasoning. Thus, reasoning is a highly specialized thinking which helps an individual to explore mentally the cause & effect relationship of an event or solution of a problem by adopting some well-organized systematic steps based on previous experience combined with present observation. Most of the recruitment tests consist of questions to assess the reasoning ability of the students.

Part-C: Verbal Ability: The dramatic changes in global economies have been matched with the transformation in technology and these have an

impact on education as well the workplace. Life skills provide students with important skills such as independent thinking, social skills, situational awareness, and communication skills needed in the campus and future workplaces. They equip the student with the requisite tools for all round development, and the requisite non-academic skills to enrich their lives.

Part-A: Quantitative Ability

Unit-1: Module 1: Linear equation or simple equation and Algebraic equation

Module 2: Number System – Prime Factorization, divisibility of a factorial number, number of zeroes, unit digit and remainders, Examples, and practice problems.

Unit-2: Module 3: LCM AND HCF – Definitions of LCM and HCF, Methods of finding LCM and HCF using Prime Factorization method and Division Method, Examples, and practice problems.

Module 4: Ratio, proportion, and variation – Definition of Ratios and Proportions, Meaning of Ratios and Proportions, Properties of Ratios, Formulas, differences between Ratios and Proportions, Examples, and practice problems.

Part-B: Reasoning Ability

Unit-3: - Module 5: Series

Module 6: Analogy

Unit-4: - Module 7: Classification

Module 8: Coding and Decoding

Part-C: Verbal Ability

Unit-5: - Module 5: Functional English; Ad-lib/ impromptu speaking sessions; JAM sessions

Module 6: Writing paragraphs (describing a process, reporting an incident, explaining an experience); Summarizing TED talks; and Letter Writing

Unit-6: Module 7: Time management; Stress Management; and Emotional intelligence

Module 8: Interpersonal skills; Team dynamics; and Leadership development

Reference Books

1. Quantitative Aptitude for Competitive Examination by Dr R S Agarwal
2. Fast Track Objective Arithmetic Paperback – 2018 by Rajesh Verma
3. Teach Yourself Quantitative Aptitude, by Arun Sharma
4. The Pearson Guide to Quantitative Aptitude for Competitive Examination by Dinesh Khattar
5. Quantitative Aptitude for all Competitive Exam by Abhijit Gupta
6. Quantitative Aptitude Quantum CAT by Sarvesh K. Verma
7. How to Prepare for Data Interpretation by Arun Sharma
8. Logical Reasoning Data Interpretation by Nishit K. Sinha
9. Analytical Reasoning (2018-2019) Session by MK Panday
10. How to Crack Test of Reasoning by Jaikishan and Premkishan [Arihant]
11. Logical Reasoning and Data Interpretation for CAT & other MBA exams by K. Sinha Nishit [Pearson]
12. Reasoning for Competitive Exams by K. Sinha Nishit [Pearson]
13. How to Prepare for Logical Reasoning for CAT by Arun Sharma [McGraw Hill]
14. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical & Critical) for Competitive Exams by Disha Experts
15. Visual Intelligence for Beginners by Matthew Alcot
16. McCarthy, Michael& Felicity O'Dell. English Vocabulary in Use beginner, Cambridge University Press, 2017.
17. McCarthy, Michael & Felicity O'Dell. English Vocabulary in Use Upper-Intermediate, Cambridge University Press, 2017.
18. McCarthy, Michael & Felicity O'Dell. English Vocabulary in Use Advanced, Cambridge University Press, 2017.
19. Sonmez, John. Soft Skills: The Software Developer's Life, Manning Publications, 2014.
20. Tulgan, Bruce. Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent, Pan Macmillan India, 2016.

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I B.TECH	ENGINEERING CHEMISTRY	L	T	P	C
II SEMESTER		3	0	0	3

Course Objectives:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard water, hard water softening methods, need of water purification and purification methods.
- To train the students on the principles& applications of electrochemistry, and how these principles are useful to understand the mechanism of corrosion & its prevention methods.
- To know the significance of polymers in household appliances and composites (FRP) in aerospace and automotive industries.
- To understand the essentiality of fuel technology, lubrication & significance of nanomaterials in modern era.

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

CO1: Understand the importance of water and its purification methods.

CO2: Demonstrate the basic principles of electrochemistry, significance of lithium-ion batteries & fuel cells, corrosion, and its prevention methods.

CO3: Explain the preparation, properties, and applications of thermoplastics & thermos settings, mechanism of conduction in polymer conductors & Significance of calorific value, refining of petroleum.

CO4: Distinguish between setting and hardening of cement.

CO5: Summarize the concepts of colloids, micelles, and nanomaterials.

UNIT I: WATER TECHNOLOGY

Soft and hardwater, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen - Boiler troubles **–**Priming, foaming**,** scale and sludge, Caustic embrittlement, Industrial water treatment – Specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards, Ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

UNIT II: ELECTROCHEMISTRY AND APPLICATIONS

Electrodes –electrochemical cell, Nernst equation, electrochemical series.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad), and lithium-ion batteries- working principle of the batteries including cell reactions; Fuel Cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

UNIT III: POLYMERS AND FUEL CHEMISTRY

Introduction to polymers, functionality of monomers, free radical mechanism of chain growth polymerization.

Thermoplastics and Thermo-setting plastics-: Preparation, properties, and applications of poly styrene. PVC Nylon and Bakelite.

Elastomers – Preparation, properties, and applications of Buna- S, Buna -N, Thiokol rubbers.

Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetane number- alternative fuels-propane, methanol, ethanol, and biofuel-bio diesel.

UNIT IV: MODERN ENGINEERING MATERIALS

Composites-Fibre reinforced plastics (CFRP &GFRP), properties and Engineering applications.

Refractories- Classification, Properties of refractory materials and Applications.

Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification, and Applications.

Building materials- Portland Cement, constituents, Setting and Hardening of cement.

UNIT V: SURFACE CHEMISTRY AND NANOMATERIALS

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids characterization of colloids (Braggs scattering method (no derivation)), preparation of nanometallic oxides by sol-gel method, stabilization of colloids and nanomaterials by stabilizing agents, adsorption isotherm (Freundlich and Langmuir), BET equation (no derivation) applications of colloids and nanomaterials.

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.

Reference Books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to colloids and surface chemistry, Butterworth-Heineman, 1992.
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition.

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I B.TECH	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS	L	T	P	C
II SEMESTER		3	0	0	3

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

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

CO1: Solve the differential equations related to various engineering fields. (L3)

CO2: Solve the second and higher order differential equations and its applications. (L3)

CO3: Identify solution methods for partial differential equations that model physical processes. (L3)

CO4: Interpret the physical meaning of different operators such as gradient, curl and divergence. (L5)

CO5: Estimate the work done against a field, circulation and flux using vector calculus. (L5)

UNIT-I: DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST

Linear differential equations - Bernoulli's equations - Exact equations and equations reducible to exact form - Applications: Newton's law of cooling - Law of natural growth and decay - Electrical circuits.

UNIT-II: LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (CONSTANT COEFFICIENTS)

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral - Wronskian, Method of variation of parameters - Simultaneous linear equations - Applications to L-C-R circuit problems and Simple harmonic motion.

UNIT-III: Partial differential equations

Introduction and formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solutions of first order linear equations using Lagrange's method - Homogeneous linear partial differential equations with constant coefficients.

UNIT-IV: Vector differentiation

Scalar and vector point functions - Vector operator del - Del applied to scalar point functions - Gradient, Directional derivative - Del applied to vector point functions - Divergence and Curl - Vector identities.

UNIT-V: Vector integration

Line integral - Circulation - Work done - Surface integral, flux - Green's theorem in the plane (without proof) - Stoke's theorem (without proof) - Volume integral - Gauss divergence theorem (without proof) and related problems.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, Mc Graw Hill Education, 2017.

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I B.TECH	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
II SEMESTER		3	0	0	3

Course Objectives

- To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes

Upon successful completion of the course, the student will be able to

CO1: Remembering the basic electrical elements and different fundamental laws. **(Remember)**

CO2: Understand the construction and operation of AC and DC machines, measuring instruments. **(Remember, Understand)**

CO3: Understand the different power generation mechanisms, Electricity billing concept, important safety measures related to electrical operations & understand the basic operation of Semiconductor Devices **(Remember, Understand)**

CO4: Understand the operation of different electronics circuits. **(Remember, Understand)**

CO5: Understand the Boolean Algebra theorems, simplify and design logic circuits and elements of sequential logic circuits. **(Remember, Understand)**

UNIT 1: DC & AC CIRCUITS

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT 2: MACHINES AND MEASURING INSTRUMENTS

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge. (Elementary Treatment only).

UNIT 3A: ENERGY RESOURCES, ELECTRICITY BILL, SAFETY MEASURES

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers. (Simple numerical problem)

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

UNIT 3B: SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier. (Elementary Treatment only)

UNIT 4: BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system. (Elementary Treatment only).

UNIT 5: DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and

Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Content Beyond the syllabus: Digital Multi-meters (Block diagram).

Text books

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition.
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, DhanpatRai& Co, 2013 .
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition.
4. R. L. Boylestad& Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
5. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference books

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.
5. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
6. SantiramKal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
7. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

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I B.TECH	ENGINEERING GRAPHICS (First angle projection only)	L	T	P	C
II SEMESTER		1	0	4	3

Course objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points and lines
- To improve the visualization skills for better understanding of plane surfaces and projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Orthographic projection.

Course Outcomes

1. Upon successful completion of the course, the student will be able to
2. **CO1:** Constructions of various engineering curves {**Apply level, KL3**}
3. **CO2:** Apply the principle of orthographic projection to points and lines {**Apply level, KL3**}
4. **CO3:** Understand and draw the projection of planes and solids inclined to both planes in first quadrant {**Understand level, KL2**}
5. **CO4:** Use the knowledge of sectional views and Development of Solid Surfaces in Real time Applications {**Apply level, KL3**}
6. **CO5:** Develop isometric drawings of simple objects reading the orthographic projections of those objects {**Analyze level, KL4**}

UNIT-I

INTRODUCTION: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

CURVES: construction of ellipse, parabola and hyperbola by general method **(Eccentricity method),** Cycloids, Involutes, Normal and tangent to Curves.

UNIT-II

ORTHOGRAPHIC PROJECTIONS: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants. **PROJECTIONS OF STRAIGHT LINES:** Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Lines Inclined to both the reference planes, Midpoint problems.

UNIT-III

PROJECTIONS OF PLANES: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

PROJECTIONS OF SOLIDS: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT-IV

SECTIONS OF SOLIDS: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in **simple position only.**

DEVELOPMENT OF SURFACES: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone in **simple position only.**

UNIT-V

CONVERSION OF VIEWS: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

COMPUTER GRAPHICS: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD **(Not for end examination).**

Learning Resources

Text books

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference books

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.
4. AutoCAD 2018 Training Guide (English, Paperback, Sagar Linkan)

Websites

1 .https://www.autodesk.com.au/campaigns/autocad-tutorials
2. https://nptel.ac.in/courses/112104172

I B.TECH	IT WORKSHOP	L	T	P	C
II SEMESTER		0	0	2	1

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes:

CO1: Perform Hardware troubleshooting.
CO2: Understand Hardware components and inter dependencies.
CO3: Safeguard computer systems from viruses/worms.
CO4: Document/ Presentation preparation.
CO5: Perform calculations using spreadsheets.

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva.

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered: - Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

\Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it

into another language. Compare the output to see how accurate and fluent the translations are.

Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

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I B.TECH	ENGINEERING MECHANICS	L	T	P	C
II SEMESTER		3	0	0	3

PRE-REQUISITES: Nil

Course objectives:

1. To get familiarized with different types of force systems.
2. To draw accurate free body diagrams representing forces and moments acting on a bodyto analyze the equilibrium of system of forces.
3. To teach the basic principles of centroid and center of gravity.
4. To determine the moment of inertia foe different composite figures and bodies.
5. To understand the kinematics and kinetics of translational and rotational motion of particle and rigidbodies.

SYLLABUS

UNIT-I

Introduction to Engineering Mechanics: Basic Concepts. Scope and Applications **Systems of Forces:** Coplanar Concurrent Forces, Components in Space, Resultant, Moment of Force and its applications, Couples and Resultant of Force Systems in plane and space.

Equilibrium of Systems of Forces: Definition, Equations of Equilibrium, Equilibrium of Coplanar concurrent and parallel force Systems.

UNIT-II

Equations of Equilibrium for Spatial System of forces. Numerical examples on spatial system of forces using vector approach.

Friction: Introduction**,** coefficient of friction, Cone of Static friction. Application to simple systems, connected systems and Ladder Friction. Analysis of plane trusses by method of joints and method of sections

UNIT-III

Centroid: Centroids of simple figures (from basic principles), Centroids of Composite Figures. **Centre of Gravity:** Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems.

UNIT-IV

Area Moments of Inertia: Definition Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, **Products of Inertia**, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass Moment of Inertia of composite bodies.

UNIT-V

Rectilinear and Curvilinear motion of a particle: Kinematics of particle with constant & Variable acceleration in Linear and angular motion, Projectile motion. D'Alembert's Principle, Work Energy method and Impulse Momentum method. **Kinematics and Kinetics of rigid body:** Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method.

Learning Resources

Text books:

1. Engineering Mechanics, S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., McGraw Hill Education 2017. 5th Edition.
2. Engineering Mechanics, P.C.Dumir- S.Sengupta and Srinivas V veeravalli , University press. 2020. First Edition.
3. A Textbook of Engineering Mechanics, S.S Bhavikatti. New age international publications 2018. 4th Edition.
4. Reddy Vijay Kumar K. and K. Suresh Kumar (2010), Singer's Engineering Mechanics.

Reference books

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill

   Education. 2017. First Edition.
2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., PHI,

2002. 4th Edition.

3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L.G.Kraige., John Wiley, 2008. 6th Edition.
4. Introduction to Statics and Dynamics, Basudev Battachatia, Oxford University Press,2014. Second Edition
5. Engineering Mechanics: Statics and Dynamics, Hibbeler R.C., Pearson Education, Inc.,

   New Delhi, 2022, 14th Edition

Websites

1. http://nptel.ac.in/
2. http://mhrd.gov.in/e-contents

I B.TECH	ENGINEERING CHEMISTRY LAB	L	T	P	C
II SEMESTER		0	0	2	1

Course Objectives:

- To verify the fundamental concepts with experiments

Course Outcomes: At the end of the course, the students will be able to
CO1: Determine the cell constant and conductance of solutions.
CO2: Prepare advanced polymer materials.
CO3: Determine the physical properties like surface tension, adsorption, and viscosity. CO4: Estimate the Iron and Calcium in cement.
CO5: Calculate the hardness of water.

List of Experiments:

1. Determination of Strength of an acid in Pb-Acid battery.
2. Determination of Hardness of a groundwater sample.
3. Estimation of Ferrous Iron by Dichrometry.
4. Conductometric titration of strong acid vs. strong base.
5. pH metry/ pH metric titration of strong acid Vs strong base.
6. potentiometric titration of strong acid vs. strong base
7. Estimation of Dissolved Oxygen by Winkler's method.
8. Preparation of a polymer (Bakelite).
9. Determine the strength of given KMnO4 by colorimetry.
10. Estimation of Calcium in port land Cement.
11. Preparation of nanomaterials by precipitation method.
12. Adsorption of acetic acid by charcoal.
13. Determination of percentage Moisture content in a coal sample.
14. Determination of Viscosity of lubricating oil by Redwood Viscometer 1.
15. Determination of Viscosity of lubricating oil by Redwood Viscometer 2.
16. Determination of Calorific value of gases by Junker's gas Calorimeter.
17. Estimation of Vitamin-C present in soft drink.

Note: A student can choose any 10 experiments from the above list

Reference:

"Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes, and B. Sivasankar

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I B.TECH	ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP	L	T	P	C
II SEMESTER		0	0	2	1

Preamble: Electrical and Electronics Engineering Workshop Lab provides the essential facilities to the students to augment their concepts about the fundamentals of Electrical and Electronics Engineering.

- To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.
- To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

Course Objectives: The student should be able to

- To understand the Electrical circuit design concept, operation of Electrical Machines and Transformer,control the speed of three phase induction motors, measurement of resistance, power, and power factor.
- To apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments.
- To analyzethe various characteristics of electrical circuits, electrical machines and measuring instruments.
- To understand the usage of electronic measuring instruments.
- To Plot and discuss the characteristics of various electron devices.

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1, Analyse the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer. (L2)

CO2, Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments, calculations for the measurement of resistance, power and power factor. (L3)

CO3, Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.(L4)

CO4, Understand the usage of electronic measuring instruments.(L2)

CO5, Plot and discuss the characteristics of various electron devices.(L3)

LIST OF EXPERIMENTS

Any Ten of the following experiments are to be conducted:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Calculation of Electrical Energy for Domestic Premises
7. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
8. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
9. Implementation of half wave and full wave rectifiers
10. Plot Input & Output characteristics of BJT in CE and CB configurations
11. Frequency response of CE amplifier.
12. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.

List of Additional Experiments: Any of the two experiments are to be conducted.

1. Measurement of Earth Resistance using Megger.
2. Simulation of RC coupled amplifier with the design supplied
3. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs
4. Measurement of parameters of choke coil.

Learning Resources

Text books

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. R. L. Boylestad& Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.

Reference books:

1. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, DhanpatRai& Co, 2013.
2. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition.
3. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata McGraw Hill, 2009
4. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

e- Resources & other digital material

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

I B.TECH	ENGINEERING MECHANICS LAB	L	T	P	C
II SEMESTER		0	0	3	1.5

Course Objectives: The students completing the course are expected to:

- Verify the Law of Parallelogram and Triangle of Forces.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Analyse the system of Pulleys and Moment of Inertia of Compound Pendulum and Flywheel.

Course outcomes: Upon successful completion of this course the student should be able to:

CO1: Analyze the coefficient of friction between two different surfaces and between the inclined plane and the roller. **(Analyze level, KL-4)**

CO2: Examine law of Polygon of forces and Law of Moment using force polygon and bell crank lever. **(Apply level, KL-3)**

CO3: Determine the Centre of gravity and Moment of Inertia of different configurations. **(Apply level, KL-3)**

CO4: Execute the equilibrium conditions of a rigid body under the action of different force systems. **(Apply level, KL-3)**

List of Experiments: Students must perform any 10 of the following Experiments.

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.
4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam.
7. Study of the systems of pulleys and draw the free body diagram of the system.

8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

References:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022

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I B.TECH	NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE	L	T	P	C
II SEMESTER		0	0	1	0.5

Course Objectives:

- The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

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

CO1: Understand the importance of discipline, character and service motto.
CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3: Explore human relationships by analyzing social problems.
CO4: Determine to extend their help for the fellow beings and downtrodden people.
CO5: Develop leadership skills and civic responsibilities.

UNIT I: ORIENTATION

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, careerguidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personaltalents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasingroad map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societalissues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II: NATURE & CAREACTIVITIES

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III: Community Service Activities

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc

ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS

iii) Conducting consumer Awareness. Explaining various legal provisions etc.

iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.

v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

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I B.TECH	LIFE SKILLS-II	L	T	P	C
II SEMESTER		2	0	0	0

Course Outcomes: After completion of the course the student will be able to:

CO 1: Enhance application skills in Business Mathematics.
CO 2: Implementation of Mathematical skills in Business.
CO 3: To improve logical visualization and counting in series, analogies and classification (non-verbal reasoning).
CO 4: Implementation of arrangement in circular and row form in daily life.
CO 5: Appreciate the importance of job requisites and attaining them.
CO 6: Recognize the importance of goal setting and building of a ethical, and personal value system.

Part-A: Quantitative Ability

Unit-1: Module 1: PERCENTAGE - Formula of percentages, Finding percentages, percentage differences, changes in percentages, computing table of percentages, fraction to percentage and vice versa, Examples and practice problems.
Module 2: PROFIT and LOSS

Unit-2: - Module 3: DISCOUNT
Module 4: PARTNERSHIP

Part-B: Reasoning Ability

Unit-3: Module 5: Counting Figures
Module 6: Non-Verbal Reasoning

Unit-4: - Module 7: Finding Missing Terms
Module 8: Arrangements
Part-C: Verbal Ability

Unit-5: - Module 9: Understanding professional communication; Contextual Usage of selected vocabulary; Contextual understanding of vocabulary in a paragraph.
Module 10: Parts of speech; Subject-verb agreement; Tenses

Unit-6: - Module 11: Introduction to employability /life skills; Career guidance; Personal grooming and projecting a positive self-image.
Module 12: Goal setting & Planning; Ethics, values & Attitude

Reference Books

1. Quantitative Aptitude for Competitive Examination by Dr R S Agarwal
2. Fast Track Objective Arithmetic Paperback – 2018 by Rajesh Verma
3. Teach Yourself Quantitative Aptitude, by Arun Sharma
4. The Pearson Guide to Quantitative Aptitude for Competitive Examination by Dinesh Khattar
5. Quantitative Aptitude for all Competitive Exam by Abhijit Gupta
6. Quantitative Aptitude Quantum CAT by Sarvesh K. Verma
7. Reasoning Ability for Competitive Examination by Dr R S Agarwal
8. A Modern Approach to Logical Reasoning (2019-20 Session) by R.S. Aggarwal [S. Chand]
9. How to Prepare for Logical Reasoning for CAT by Arun Sharma [McGraw Hill]
10. Multidimensional Reasoning by Mishra and Kumar Dr. Lal [Upkar's]
11. A Modern Approach to Verbal & Non-Verbal Reasoning (2019-20 Session) by R.S. Aggarwal [S. Chand]
12. A New Approach to Reasoning Verbal & Non-Verbal by B.S. Sijwali and Indu Sijwali [Arihant]
13. Analytical Reasoning (2018-2019) Session by MK Panday
14. How to Crack Test of Reasoning by Jaikishan and Premkishan [Arihant]
15. Logical Reasoning and Data Interpretation for CAT & other MBA exams by K. Sinha Nishit [Pearson]
16. Reasoning for Competitive Exams by K. Sinha Nishit [Pearson]
17. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical & Critical) for Competitive Exams by Disha Experts
18. Visual Intelligence for Beginners by Matthew Alcot
19. Logical Reasoning & Data Interpretation by Nishit K. Sinha
20. McCarthy, Michael& Felicity O'Dell. English Vocabulary in Use beginner, Cambridge University Press, 2017.
21. McCarthy, Michael & Felicity O'Dell. English Vocabulary in Use Upper-Intermediate, Cambridge University Press, 2017.
22. McCarthy, Michael & Felicity O'Dell. English Vocabulary in Use Advanced, Cambridge University Press, 2017.
23. Sonmez, John. Soft Skills: The Software Developer's Life, Manning Publications, 2014.
24. Tulgan, Bruce. Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent, Pan Macmillan India, 2016

II Year	TRANSFORMS AND NUMERICAL METHODS	L	T	P	C
I Semester		3	0	0	3

Course Objectives:

1. To elucidate the different numerical methods to solve nonlinear algebraic equations.
2. To disseminate the use of different numerical techniques for carrying out numerical integration.
3. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Outcomes:

1. Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3).
2. Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3).
3. Apply the Laplace transform for solving differential equations (L3).
4. Find or compute the Fourier series of periodic signals (L3).
5. Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3).

UNIT – I: Iterative Methods:

Introduction-Solution of algebraic and transcendental equations: Bisection method-Secant method, Method of false position- Iteration method-Newton-Raphson method (Simultaneous Equations).

Interpolation: Newton's forward and backward formulae for interpolation-Interpolation with unequal intervals- Lagrange's interpolation formula.

UNIT – II: Numerical integration, Solution of ordinary differential equations with initial conditions:

Trapezoidal rule-Simpson's 1/3rd and 3/8th rule-Solution of initial value problems by Taylor's series method- Picard's method of successive approximations-Euler's method-Runge- Kutta method (second and fourth order)- Milne's Predictor and Corrector Method.

UNIT –III: Laplace Transforms:

Definition of Laplace transform-Laplace transforms of standard functions-Properties of Laplace Transforms-Shifting theorems-Transforms of derivatives and integrals-Unit step function-Dirac's delta function-Inverse

Laplace transforms-Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) and integro differential equations using Laplace transforms.

UNIT – IV: Fourier series:

Introduction–Periodic functions–Fourier series of periodic function-Dirichlet's conditions-Even and odd functions-Change of interval-Half-range sine and cosine series.

UNIT – V: Fourier Transforms:

Fourier integral theorem (without proof)-Fourier sine and cosine integrals-Infinite Fourier

Transforms-Sine and cosine transforms-Properties-Inverse transforms-Convolution theorem (without proof)-Finite Fourier transforms.

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.

2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill

Education.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

2. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineering and

Science, Tata Mc. Graw Hill Education.

3. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and

Engineering Computation, New Age International Publications.

4. Lawrence Turyn, Advanced Engineering Mathematics, CRC Press.

II Year	UNIVERSAL HUMAN VALUES– UNDERSTANDING HARMONY & ETHICAL HUMAN CONDUCT	L	T	P	C
I Semester		2	1	0	3

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I

Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself Lecture 3: self-exploration as the Process for Value Education

Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II

Harmony in the Human Being (6 lectures and 3 tutorials for practice session) Lecture 7: Understanding Human being as the Co-existence of the self and the body.

Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.

Lecture 9: The body as an Instrument of the self Lecture 10: Understanding Harmony in the self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self Lecture 11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III

Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV

Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education PS1 Sharing about Oneself

PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence) PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self- exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up" ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf

3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3- S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023- 25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human- values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II Year	THERMODYNAMICS	L	T	P	C
I Semester		2	0	0	2

Pre-Requisites:

1) Engineering Mathematics
   I. Calculus
   II. Differential Equations
2) Engineering Chemistry
3) Engineering Physics

Course objectives:

The student should be able to

1. Define basic thermodynamic concepts and review temperature and temperature scales.
2. Introduce energy, its various forms, and solve energy balance problems for closed and open systems involving heat and work interactions for pure substances, ideal gases, and incompressible substances.
3. Apply the second law of thermodynamics to cycles and cyclic devices, develop the absolute thermodynamic temperature scale, and establish the entropy increase principle.
4. Illustrate P-v, T-v, and P-T diagrams and P-v-T surfaces of pure substances, determine thermodynamic properties from tables, and relate specific heat to internal energy and enthalpy of ideal gases. Predict the P-v-T behavior of gas mixtures using Dalton's and Amagat's laws.
5. Use the Psychrometric chart to determine the properties of atmospheric air and understand Psychrometric properties and processes related to human comfort.

Course Outcomes:

Upon successful completion of the course, the student will be able to

CO1: Explain the fundamental concepts of thermodynamics, including energy transfer by heat and work (covering various forms of work), and review the concepts of temperature and temperature scales. {**Understand level, KL2**}

CO2: State and **explain** the laws of thermodynamics, and **solv**e energy balance problems for closed (fixed mass) and open (fixed volume) systems involving heat and work interactions for pure substances, ideal gases, and incompressible substances. {**Apply level, KL3**}

CO3: Apply the second law of thermodynamics to cycles and cyclic devices, develop the absolute thermodynamic temperature scale, and establish the principle of entropy increase. {**Apply level, KL3**}

CO4: Analyze the thermodynamic properties of pure substances using steam tables, **relate** specific heat to the internal energy and enthalpy of an ideal gas, and apply the ideal gas law to various processes. {**Analyze level, KL4**}

CO5: Use the Psychrometric chart to **compute** the properties of atmospheric air, **calculate** various heat loads, and **understand** human comfort. {**Apply level, KL3**}

UNIT-I

BASIC CONCEPTS AND DEFINITIONS: Macroscopic and Microscopic viewpoints, Thermodynamic System, Surrounding, Boundary, Universe, Control Volume, Control Surface, Classes of Systems, State, Thermodynamic Properties, Process and Cycles, Thermodynamic Equilibrium, Reversibility, Quasi static Process, Concept of Continuum, Specific heat at constant volume, Enthalpy, Specific heat at constant pressure, Zeroth Law of Thermodynamics Statement. **(05 hrs)**

WORK AND HEAT TRANSFER: Work transfer, P-dv work, Path and Point Functions, P-dv work in various Quasi-Static Processes, Types of Work Transfer, Free expansion with zero work transfer, Heat Transfer-a path function. **(05 hrs)**

UNIT-II

FIRST LAW OF THERMODYNAMICS: First law for a closed system undergoing a cycle(Joule's experiment) and a change of state, Energy- a property of the system, Energy in Stored and in Transition, Different forms of stored energy, limitations of the first law, PMMI. **(05 hrs)**

THERMODYNAMIC ANALYSIS OF CONTROL VOLUME: Conservation of Energy Principle-Flow work, The Steady Flow Process-Steady Flow Energy Equation, Steady Flow Engineering Devices-Nozzles, Diffuser, Turbine & Throttling Valves **(05 hrs)**

UNIT-III

SECOND LAW OF THERMODYNAMICS: Introduction, Thermal Energy, Reservoirs, Heat Engines, Refrigerators, Heat Pumps, Kelvin-Planck & Clausius Statements of Second law of Thermodynamics, Equivalence of Kelvin-Plank and Clausius Statements, PMM II, Differences between

reversible and Irreversible Process, Carnot Cycle and its specialties, Carnot Theorem, Corollary of Carnot's theorem, Thermodynamic scale of Temperature. **(07 hrs)**

ENTROPY: Clausius Inequality, Entropy - Principle of Entropy Increase, Entropy Change for Ideal gases, Availability and Irreversibility (only definitions), Elementary Treatment of the Third Law of Thermodynamics. *Second-law analysis of heat engines, Refrigerators and heat pumps*. **(03 hrs)**

UNIT-IV

PROPERTIES OF PURE SUBSTANCES: Pure Substances, Phases of Pure Substance, Properties of steam, p-v, p-T, T-s and h-s diagrams, P-V-T-surfaces, Dryness Fraction, Steam tables, Measurement of Steam Quality. **(05 hrs)**

PERFECT GAS LAWS: Avogadro's law, Equation of State of a ideal gas, specific heats, Internal energy and Enthalpy of an ideal gas, Reversible Adiabatic Process, Reversible Isothermal process, Polytropic Process, entropy change of an ideal gas. **(03 hrs)**

MIXTURES OF PERFECT GASES: Dalton's Law of partial pressure, Amagat`s Laws of additive volumes. **(02 hrs)**

UNIT-V

Introduction to Air Conditioning: Psychrometric properties (dry bub temperature, wet bulb temperature, wet bulb depression, dew point temperature, dew point depression, relative humidity, specific enthalpy, degree of saturation & enthalpy of moisture air) & processes (sensible heating, sensible cooling process, humidifying process, dehumidifying process, heating and humidifying process, cooling and dehumidifying process, cooling and humidifying process, heating and dehumidifying process) – characterization of sensible and latent heat loads – load concepts of SHF. **(06 hrs)**

Requirements of human comfort and concept of effective temperature-comfort chart –comfort air conditioning, and load calculations. **(04 hrs)**

Content Beyond the Syllabus: *Second-law analysis of heat engines, Refrigerators and heat pumps*

Text books:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

Reference books:

1. J.P.Holman, Thermodynamics, McGraw Hill Publications -2003.
2. Richard E.Sonntag,Claus Borgnakke,Gordon J.Van Wylen,Fundamentals of Thermodynamics, Six Edition, Wiley-India Edition.
3. E.Rathakrishnan, Fundamentals of Engineering Thermodynamics, PHI, 2nd Edition, 2010.
4. Prasanna Kumar, Thermodynamics, First Edition, Pearson Publications.
5. R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010.
6. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021.

e- Resources & other digital material:

1. https://nptel.ac.in/courses/112/105/112105266/
2. https://nptel.ac.in/courses/103/103/103103144/
3. https://nptel.ac.in/courses/112/105/112105220/
4. https://nptel.ac.in/courses/101/104/101104067/
5. https://nptel.ac.in/courses/101/104/101104063/
6. https://nptel.ac.in/courses/103/104/103104151/

Data books to be allowed in examinations:

1. S.C. Jain, Steam Tables, Birla Publications Pvt. Ltd – 2011.
2. R.S. Khurmi & N. Khurmi, Steam Tables, S.Chand Publications – 2014.

II Year	MECHANICS OF SOLIDS	L	T	P	C
I Semester		3	0	0	3

Pre-Requisites:

1) Engineering Mathematics
2) Engineering Mechanics

Course objectives:

The students will acquire the knowledge to
1. Understand the stresses & deformations of a member due to axial loading under different conditions.
2. Determine the shear force and bending moment in beams under various loading conditions.
3. Understand the concepts of bending and torsion theories.
4. Analyze principal stresses in uni-axial & bi-axial members and also design of thin & thick cylinders.
5. Analyze the deflections in beams and columns.

Course outcomes:

Upon successful completion of this course the student should be able to:

1. Compute the stresses & deformations of a member due to axial loading under uniform and non-uniform conditions. **(Apply level, KL3)**

2. Solve the variation of SF & BM in determinate beams. **(Apply level, KL3)**

3. Examine the structural members subjected to flexural and torsion loads. **(Apply level, KL3)**

4. Determine the biaxial stresses developed at a point of stressed member and analyze the thin Pressure vessels. **(Apply level, KL3)**

5. Understand the concepts of deflections for statically determinate beams and buckling of Columns. **(Understand level, KL2)**

UNIT-I

SIMPLE STRESSES & STRAINS: Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for different materials –Working stress–Factor of safety.

Lateral strain, Poisson's ratio & volumetric strain – composite bars– Temperature stresses- Relation between elastic constants. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT-II

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams – Concept of shear force and bending moment – Relation between S.F., B.M and rate of loading at a section of abeam.

S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L, uniformly varying loads and combination of these loads – Point of contra flexure.

UNIT-III

FLEXURAL STRESSES:

Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

TORSION: Introduction-Derivation- Torsion of Circular shafts -Pure Shear- Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT-IV

PRINCIPAL STRESSES AND STRAINS: Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle. Stress strain analysis of 3-D element.

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 cylinders.

THICK CYLINDERS: Lame's equation – cylinders subjected to inside & outside pressures.

UNIT-V

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Determination of slope and deflection for cantilever and simply supported

beams subjected to point loads, U.D.L, uniformly varying loads by Double integration method, Macaulay's method and moment area method.

COLUMNS: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula.

Text books

1. Mechanics of Materials-Gere and Timoshenko, Second edition CBS, Publications.
2. Strength of materials by R.K. Bansal, Laxmi Publications-Sixth edition.

References

1. Strength of materials by B.C. Punmia-lakshmi publications Pvt. Ltd, New Delhi.- Tenth edition
2. Strength of materials -GH Ryder- Mc Millan publishers,2002 India Ltd
3. Strength of Materials -By Jindal, Umesh Publications, 1 edition
4. Solid Mechanics, Egor P. Popov. Published by Pearson 1998.
5. Strength of materials by S. Ramamrutham-16/e- Dhanpat Rai Publishing Co Pvt. Ltd.

e- Resources & other digital material:

1. https://nptel.ac.in/courses/112/102/112102284/
2. https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-ce17/
3. https://onlinecourses.nptel.ac.in/noc20_me84/preview
4. https://www.youtube.com/watch?v=kpAnsW-WB58

II Year	MATERIAL SCIENCE & METALLURGY	L	T	P	C
I Semester		3	0	0	3

Course Objective:

- Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
- Study the behavior of ferrous and non-ferrous metals and alloys and their application in different domains
- Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
- Grasp the methods of making of metal powders and applications of powder metallurgy
- Comprehend the properties and applications of ceramic, composites and other advanced methods

Course Outcomes:

CO1: Understand the crystalline structure of different metals and study the stability of phases in different alloy systems. (L2)

CO2: Study the behavior of ferrous and non-ferrous metals and alloys and their application in different domains. (L1)

CO3: Understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals. (L2)

CO4: Grasp the methods of making of metal powders and applications of powder metallurgy. (L3)

CO5: Comprehend the properties and applications of ceramic, composites and other advanced methods. (L4)

UNIT– I

Structure of Metals and Constitution of alloys: Crystallization of metals, Packing Factor - SC, BCC, FCC & HCP- line density, plane density. Grain and grain boundaries, effect of grain boundaries – determination of grain size.

Imperfections, Slip and Twinning.

Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and

heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe_3C.

UNIT–II

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast iron. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys: Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT–III

Heat treatment of Steels: Effect of alloying elements on Fe-Fe_3C system, annealing, normalizing, hardening, tempering, hardenability, TTT diagrams, surface - hardening methods, age hardening treatment, Cryogenic treatment.

UNIT–IV

Powder Metallurgy: Basic processes- Methods of producing metal powders- milling atomization- Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Secondary operations, Applications of powder metallurgical products.

UNIT– V

Ceramic and Advanced materials: Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, manufacturing methods, particle reinforced composites, fiber reinforced composites, PMC, MMC, CMC and CCCs. Introduction to Nanomaterials and smart materials.

Text Books:

1. Dr. V. D. Kodgire, Material Science and Metallurgy, 39/e, Everest Publishing House, 2017.
2. S. H. Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw-Hill, 1997.

3. Donald R.Askeland, Essentials of Materials science and Engineering, 4/e, CL Engineering publications, 2018.

Reference Books:

1. V. Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.
3. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.
4. Yip-Wah Chung, Introduction to Material Science and Engineering, 2/e, CRC Press, 2022.
5. A V K Suryanarayana, Material Science and Metallurgy, B S Publications, 2014.
6. U. C. Jindal, Material Science and Metallurgy, 1/e, Pearson Publications, 2011.

Online Learning Resources:

- https://archive.nptel.ac.in/courses/113/106/113106032/
- https://www.edx.org/learn/mechanics/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-3-time-dependent-behavior.
- https://www.youtube.com/watch?v=9Sf278j1GTU
- https://www.coursera.org/learn/fundamentals-of-materials-science
- https://www.coursera.org/learn/material-behavior.

II Year	MECHANICS OF SOLIDS &	L	T	P	C
I Semester	MATERIAL SCIENCE LAB	0	0	3	1.5

Course Objectives:

- Evaluate the values of yield stress, ultimate stress and bending stress of the given specimen under tension test and bending test
- Conduct the torsion test to determine the modulus of rigidity of given specimen.
- Justify the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
- Examine the stiffness of the open coil and closed coil spring and grade them.
- Analyze the microstructure and characteristics of ferrous and non ferrous alloy specimens.

Course Outcomes:

CO1: Understand the stress strain behavior of different materials. (L2)

CO2: Evaluate the hardness of different materials. (L4)

CO3: Explain the relation between elastic constants and hardness of materials. (L1)

CO4: Identify various microstructures of steels and cast irons. (L3)

CO5: Evaluate hardness of treated and untreated steels. (L4)

NOTE: Any 6 experiments from each section A and B.

A) MECHANICS OF SOLIDS LAB:

1. Tensile test
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
   a) Brinell's hardness test
   b) Rockwell hardness test
   c) Vickers hardness test
5. Test on springs

6. Impact test
   a) Charpy test
   b) Izod test
7. Punch shear test
8. Liquid penetration test

B) MATERIAL SCIENCE LAB:

1. Preparation and study of the Microstructure of pure metals.
2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, and High carbon steels.
3. Study of the Microstructures of Cast Irons.
4. Study of the Microstructures of Non-Ferrous alloys.
5. Study of the Microstructures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.

Virtual lab:

1. To investigate the principal stresses σa and σb at any given point of a structural element or machine component when it is in a state of plane stress. (https://virtual-labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html)
2. To find the impact resistance of mild steel and cast iron.(https://sm-nitk.vlabs.ac.in/exp/izod-impact-test).
3. To find the impact resistance of mild steel.(https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/index.html)
4. To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc. (https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test)
5. To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine. (https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test).

II Year	COMPUTER-AIDED MACHINE DRAWING	L	T	P	C
I Semester		0	0	3	1.5

Course Objectives

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D and 3D assembly drawings and Familiarize with limits, fits, and tolerances in mating components

Course Outcomes:

CO1: Demonstrate the conventional representations of materials and machine components. (L3)

CO2: Model riveted, welded and key joints using CAD system. (L6)

CO3: Create solid models and sectional views of machine components. (L6)

CO4: Generate solid models of machine parts and assemble them. (L5)

CO5: Translate 3D assemblies into 2D drawings. (L6)

The following are to be done by any 2D software package

Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldham's' coupling.

The following exercises are to be done by any 3D software package:

Sectional views:

Creating solid models of complex machine parts and sectional views.

Assembly drawings: (Any four of the following using solid model software)

Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling.

Textbooks:

1 Machine Drawing by K. L. Narayana, P.Kannaiah and K.Venkat Reddy, New Age International Publishers, 3/e, 2014
2 Machine drawing by N.Sideshwar, P. Kannaiah, V.V.S.Sastry, TMH Publishers. 2014.

Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014.

Online Learning Resources:

- https://eeedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf
- https://archive.nptel.ac.in/courses/112/105/112105294/
- https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked_from=autocomplete&c=autocomplete
- https://www.youtube.com/watch?v=0bQkS3_3Fq4

II Year	PYTHON PROGRAMMING LAB	L	T	P	C
I Semester		0	0	2	1

Course Objectives:

1. Fundamental Understanding: Develop a solid foundation in Python programming, covering essential syntax, semantics, and constructs.

2. Data Manipulation: Equip students with skills to handle and manipulate data using Python libraries like Pandas and NumPy.

3. Problem-Solving: Enhance problem-solving abilities by implementing various algorithms and data structures in Python.

4. Advanced Techniques: Introduce advanced Python topics such as web scraping, API interaction, and database management.

Course Outcomes:

CO1: Analyse essentials of Python Programming fundamentals

CO2: Explore different data manipulation techniques

CO3: Use different problem-solving techniques, Python Data structures and data management

Basic Task - Install Python and an IDE (e.g., PyCharm, VSCode, or Jupyter Notebook).

Program List

1. Check whether a given triangle is an equilateral triangle or not.
2. Implement Python code to Convert given rupees into US Dollars, Singapore Dollars, Euros, Dinars
3. There are 3 kids in a family. Find out who is youngest among the three of the family. Assume that age is given as input.
4. If the total selling price of 15 items and the total profit earned on them is input through the keyboard, write a program to find the cost price of one item.

5. Write a program to calculate overtime pay of 10 employees. Overtime is paid at the rate of Rs. 50/- per hour for every hour worked above 40 hours. Assume that employees do not work for fractional part of an hour.
6. Prepare Python code to find out number of digits in a given number.
7. Write a program to enter the numbers till the user wants and at the end it should display the count of positive, negative and zeros entered.
8. Write a script that imports and utilizes standard library module 'random' to generate a set of random numbers and to find biggest and smallest among the numbers.
9. Prepare number of lines, words, characters in a given paragraph using lists.
10. You are tasked with analysing the temperature readings from a series of sensors placed along a production line. The sensors record temperatures at regular intervals throughout the day. You need to perform the following tasks:

    a. Calculate the average temperature.

    b. Identify the maximum and minimum temperatures recorded.

    c. Find the difference between the maximum and minimum temperatures.

11. You are an engineer working on a project to monitor and analyze the performance of multiple machines in a factory. Each machine records its performance metrics daily, including temperature, pressure, and vibration levels. These metrics are stored in tuples, with each tuple representing the readings from a single machine for a day. You need to perform the following tasks:

    a. Store the performance metrics for a week.

    b. Calculate the average temperature, pressure, and vibration level for each machine.

    c. Identify the day with the highest temperature, pressure, and vibration level for each machine.

12. Find the frequency of alphabets in a given sentence.
13. Perform word based reverse operation on the given sentence. Ex: Input: "There is no substitute for Hard Work"; output: "Work Hard for substitute no is There".
14. Demonstrate various any 5 string methods in Python with example codes.

15. Write a python program to copy the content of one file to another.
16. Implement Matrix operations: add, subtract, multiply using numpy library in Python.
17. Read a student data file (XL) and find the average marks, lowest and highest marks in a class using numPy and Pandas library.
18. Using the libraries in Python present the data in tabular form available in JSON form using API.

Prescribed Text Books:

1. Core Python Programming, Dr R Nageswara Rao, 2nd Edition, Dreamtech Publication
2. Python: Complete Reference, Martin C Brown, Tata Mc-Graw Hill, Indian Edition

Learning Resources:

- https://www.udemy.com/course/python-the-complete-python-developer-course/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaig n=BG-
- Python_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=u demyads&utm_source=bing&utm_term=_._ag_1220458320107116_._ _ad ._kw_Pyt hon+language_._de_c_._dm ._pl ._ti_kwd-
- https://www.w3schools.com/python/python_intro.asp
- https://www.youtube.com/watch?v=eWRfhZUzrAc
- https://onlinecourses.nptel.ac.in/noc20_cs83/preview
- https://www.edx.org/learn/python
- Virtual Labs - https://python-iitk.vlabs.ac.in/
- Virtual Labs - https://virtual-labs.github.io/exp-arithmetic-operations-iitk/
- Virtual Labs - https://cse02-iiith.vlabs.ac.in/
  https://mlritm.ac.in/assets/cse/cse_lab_manuals/R20_cse_manuals/Python%20Lab%20Manua l.pdf

II Year	EMBEDDED SYSTEMS AND IOT	L	T	P	C
I Semester		0	1	2	2

Course Objectives:

- To comprehend Microcontroller-Transducers Interface techniques
- To establish Serial Communication link with Arduino
- To analyse basics of SPI interface.
- To interface Stepper Motor with Arduino
- To analyse Accelerometer interface techniques
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices.

Course Outcomes:

CO1: Comprehend Microcontroller-Transducers Interface techniques. (L4)

CO2: Establish Serial Communication link with Arduino. (L6)

CO3: Analyse basics of SPI interface. (L4)

CO4: Understand the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor. (L2)

CO5: Realize the revolution of internet in mobile devices, cloud and sensor networks. (L3)

Embedded Systems Experiments: (Any 5 experiments from the following)

1. Measure Analog signal from Temperature Sensor.
2. Generate PWM output.
3. Drive single character generation on Hyper Terminal.
4. Drive a given string on Hyper Terminal.
5. Full duplex Link establishment using Hyper terminal.
6. Drive a given value on a 8 bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on Hyper Terminal. COMPONENTS/ BOARDS: 1. Arduino Duemilanove Board 2. Arduino Software IDE.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
4. Embedded Systems-Lyla B.Das-Pearson Publications,2013.

Internet of Things Experiments: (Any 5 experiments from the following)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
3. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.
4. Raspberry Pi interact with online services through the use of public APIs and SDKs.
5. Study and Install IDE of Arduino and different types of Arduino.
6. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
7. Calculate the distance using distance sensor Using Arduino.
8. Basic LED functionality Using Arduino.
9. Calculate temperature using temperature sensor Using Arduino.
10. Calculate the distance using distance sensor Using Node MCU.
11. Basic LED functionality Using Node MCU.

Text Books:

1. Arsheep Bahga &Vijay Madisetti, Internet of Things - A Hands-on Approach, 1/e, Orient Blackswan Private Limited - New Delhi, 2015.
2. Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,.

Online Learning Sources

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview
3. https://archive.nptel.ac.in/courses/108/105/108105057/

4. https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin- embedded-systems-shape-the-world microcontroller input output?index=product & objectID=course-785cf551-7f66-4350-b736-64a93427b4db & webview=false & campaign=Embedded+Systems+-

   +Shape+The+World%3A+Microcontroller+Input%2F Output & source=edX & product_category=course &

   placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems

5. https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of things?index=product&queryID=e1322674dcb3d246be981d0669265399&position=4 &linked_from=autocomplete&c=autocomplete

6. https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3 &results_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product_c ategory=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch

7. Virtual Labs - http://vlabs.iitkgp.ac.in/rtes/

8. Virtual Labs - https://cse02-iiith.vlabs.ac.in/

9. Virtual Labs - https://iotvirtuallab.github.io/vlab/Experiments/index.html

II Year	ENVIRONMENTAL SCIENCE	L	T	P	C
I Semester		2	0	0	0

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes:

CO1: Grasp multi-disciplinary nature of environmental studies and various renewable and non-renewable resources. (L2)
CO2: Understand flow and bio-geo- chemical cycles and ecological pyramids. (L2)
CO3: Understand various causes of pollution and solid waste management and related preventive measures. (L2)
CO4: Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation. (L2)
CO5: Understand the causes of population explosion, value education and welfare programmes. (L3)

UNIT – I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture,

fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.

b. Water pollution

c. Soil pollution

d. Marine pollution

e. Noise pollution

f. Thermal pollution

g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses,Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. https://www.edx.org/learn/environmental-science/rice-university-ap-r- environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science+
3. +Part+3%3A+Pollution+and+Resources&source=edX&product_category=course& placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental- science
4. http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf
5. https://www.youtube.com/watch?v=5QxxaVfgQ3k

II Year	INDUSTRIAL MANAGEMENT	L	T	P	C
II Semester		2	0	0	2

Course Objectives: The objectives of the course are to

- Introduce the scope and role of industrial engineering and the techniques for optimal design of layouts
- Illustrate how work study is used to improve productivity
- Explain TQM and quality control techniques
- Introduce financial management aspects and
- Discuss human resource management and value analysis.

Course Outcomes:

CO1: Learn about how to design the optimal layout. (L1)

CO2: Demonstrate work study methods. (L3)

CO3: Explain Quality Control techniques. (L2)

CO4: Discuss the financial management aspects. (L2)

CO5: Understand the human resource management methods. (L2)

UNIT– I

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

PLANT LAYOUT: Factors governing plant location, types of production layouts,
advantages and disadvantages of process layout and product layout, applications, plant maintenance, preventive and break down maintenance.

UNIT–II

WORK STUDY: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

UNIT–III

STATISTICAL QUALITY CONTROL: Quality control, SQC, attribute sampling inspection with single and double sampling, Control charts – X and R –charts, P-Chart and C- Chart their applications, numerical examples.

TOTAL QUALITY MANAGEMENT: zero defect concept, quality circles, implementation, applications, Six Sigma–definition, basic concepts

UNIT– IV

FINANCIAL MANAGEMENT: Scope and nature of financial management, Sources of finance, Management of working capital, estimation of working capital requirements, Capital budgeting – Nature of Investment Decisions – Investment Evaluation criteria- NPV, IRR, PI, Payback Period, and ARR, numerical problems.

UNIT–V

HUMAN RESOURCE MANAGEMENT: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job evaluation, its importance and types, merit rating, quantitative methods, Concept of Performance appraisal.

VALUE ANALYSIS: Value engineering, implementation procedure, enterprise resource planning and Bench Marking.

Text Books:

1. O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd, 2018.
2. Mart and Telsang, Industrial Engineering and Production Management, S.Chand & Company Ltd. New Delhi, 2006.

Reference Books:

1. Bhattacharya DK, Industrial Management, S.Chand, publishers, 2010.
2. J.G Monks, Operations Management,3/e, McGraw Hill Publishers1987.
3. T.R. Banga, S.C.Sharma, N. K. Agarwal, Industrial Engineering and Management Science, Khanna Publishers, 2008.
4. Koontz O' Donnell, Principles of Management, 4/e, McGraw Hill Publishers, 1968.
5. R.C. Gupta, Statistical Quality Control, Khanna Publishers, 1998.
6. NVS Raju, Industrial Engineering and Management,1/e, Cengage India Private Limited, 2013.

Online Learning Sources:

1. https://onlinecourses.nptel.ac.in/noc21_me15/preview

2. https://onlinecourses.nptel.ac.in/noc20_mg43/preview
3. https://www.edx.org/learn/industrial-engineering
4. https://youtube.com/playlist?list=PL299B5CC87110A6E7&si=TghLCbEobuxjEaXi
5. https://youtube.com/playlist?list=PLbjTnjt5Gkl0z3OHOGK5RB9mvNYvnImW&si=oaX_5RG69hS3v2ll

II Year	COMPLEX VARIABLES, PROBABILITY AND STATISTICS	L	T	P	C
II Semester		3	0	0	3

Course Objectives:

1. To familiarize the complex variables.
2. To familiarize the students with the foundations of probability and statistical methods.
3. To equip the students to solve application problems in their disciplines.

Course Outcomes:

1. Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3).
2. Make use of the Cauchy residue theorem to evaluate certain integrals (L3).
3. Infer the statistical inferential methods based on small and large sampling tests (L4).
4. Find the differentiation and integration of complex functions used in engineering problems (L5).
5. Design the components of a classical hypothesis test (L6).

UNIT– I: Functions of a complex variable and Complex integration:

Introduction-Continuity-Differentiability-Analyticity-Cauchy-Riemann equations in Cartesian and polar coordinates-Harmonic and conjugate harmonic functions-Milne–Thompson method.

Complex integration: Line integral-Cauchy's integral theorem-Cauchy's integral formula-Generalized integral formula (all without proofs) and problems on above
theorems.

UNIT–II: Series expansions and Residue Theorem:

Radius of convergence-Expansion of function in Taylor's series, Maclaurin's series and Laurent's series.

Types of Singularities: Isolated-Essential singularities-Pole of order m - Residues-Residue theorem (without proof)-Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_{C}^{c+2\pi} f(\cos\theta,\sin\theta)d\theta.$

UNIT – III: Probability and Distributions:

Review of probability and Baye's theorem-Random variables-Discrete and Continuous random variables.

Distribution functions: Probability mass function, Probability density function and Cumulative distribution functions-Mathematical Expectation and Variance-Binomial, Poisson, Uniform and Normal distributions.

UNIT – IV: Sampling Theory:

Introduction-Population and Samples-Sampling distribution of Means and Variance (definition only)-Central limit theorem (without proof)-Representation of the normal theory distributions-Introduction to t, χ^2 and F-distributions-Point and Interval estimations-Maximum error of estimate,

UNIT – V: Tests of Hypothesis:

Introduction-Hypothesis-Null and Alternative Hypothesis-Type I and Type II errors-Level of significance-One tail and two-tail tests-Tests concerning one mean and two means (large and small samples)- Tests on proportions.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers.
2. Miller and Freund's, Probability and Statistics for Engineers,7/e,Pearson,2008.

ReferenceBooks:

1. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 9/e, Mc-Graw
1. Hill,2013.
2. S.C.Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics,11/e, Sultan Chand
3. &Sons Publications,2012.
4. Jay l. Devore, Probability and Statistics for Engineering and the Sciences,8/e, Cengage
5. publishers.
3. ShronL. Myers, KeyingYe, Ronald E Walpole, Probability and StatisticsEngineers and the
6. Scientists,8/e,Pearson publishers, 2007.
4. Sheldon, M.Ross, Introduction to probability and statistics Engineers and the Scientists, 4/e, Academic Foundation,2011.

II Year	MANUFACTURING PROCESSES	L	T	P	C
II Semester		3	0	0	3

Course Objective: The objectives of the course are to

- Know the working principle of different metal casting processes and gating system.
- Classify the welding processes, working of different types of welding processes and welding defects.
- Know the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Understand the principles of forging, tools and dies, working of forging processes.
- Know about the Additive manufacturing.

Course Outcomes:

CO1: Design the patterns and core boxes for metal casting processes. (L6)

CO2: Understand the different welding processes. (L2)

CO3: Demonstrate the different types of bulk forming processes. (L3)

CO4: Understand sheet metal forming processes. (L2)

CO5: Learn about the different types of additive manufacturing processes. (L2)

UNIT– I

Casting: Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern making allowances, Sand Molding, different types of cores, Principles of Gating, Risers, casting design considerations. Melting practice and furnaces, Solidification of castings and casting defects- causes and remedies. Basic principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

UNIT–II

Welding Processes: Classification of welding processes, characteristics of welding process, types of welded joints and positions, edge preparation,

Gas welding - Different types of Oxy-acetylene flames and uses, Gas cutting. Principle of Arc welding, equipment and their characteristics, Manual metal arc welding, submerged arc welding, TIG& MIG welding.

UNIT–III

Other Welding Processes: Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Electro–slag welding, Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Brazing and Soldering.

Heat affected zones in welding; pre & post heating, welding defects –causes and remedies.

UNIT– IV

Metal Forming: Hot working and Cold working - Strain hardening and Annealing. Rolling – fundamentals, types of rolling mills and products of rolling, Forces in rolling and power requirements. Forging-Types of Forging – Drop, Press and Upset forging, forging defects and remedies; Extrusion and its characteristics. Types of extrusion- forward and backward extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

UNIT -V

Sheet metal forming- Presses and press tools, Blanking and punching, Punch and die clearances, Coining, Embossing, Drawing and Deep Drawing, Bending, Spring back and its remedies, Metal Spinning, Stretch forming.

High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

Textbooks:

1. R. K. Jain, Production Technology, Vol. 1, Khanna Publishers.
2. Kalpakjian S and Steven R Schmid, Manufacturing Engineering and Technology, 7/e, Pearson Publications.
3. P. N. Rao, Manufacturing Technology -Vol I, 5/e, McGraw Hill Education.

Reference Books:

1. A.Ghosh & A.K.Malik, Manufacturing Science, East West Press Pvt.

Ltd,.
2. Lindberg and Roy, Processes and materials of manufacture, 4/e, Prentice Hall India Learning Private Limited.
3. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing.
4. H.S. Shaun, Manufacturing Processes, 1/e, Pearson Publishers.
5. WAJ Chapman , Workshop Technology, 5/e, CBS Publishers & Distributors Pvt. Ltd,.
6. Hindustan Machine Tools, Production Technology, Tata McGraw Hill Publishers.

Online Learning Resources:

- https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes
- https://onlinecourses.nptel.ac.in/noc21_me81/preview
- https://archive.nptel.ac.in/courses/112/103/112103263/
- https://elearn.nptel.ac.in/shop/nptel/principles-of-metal-forming-technology/?v=c86ee0d9d7ed

II Year	FLUID MECHANICS &	L	T	P	C
II Semester	HYDRAULIC MACHINES	3	0	0	3

PRE-REQUISITES: Engineering Physics, Engineering Mathematics

Course objectives: The student should be able to

- Discuss fluid properties, pressure variations, measurement techniques, and flow field illustrations.
- Solve problems using Bernoulli's equation; analyze flow measuring devices and pipe flows.
- Understand boundary layer flow, calculate lift and drag on shapes, and solve jet impact problems.
- Overview of hydraulic turbines and performance curves.
- Solve problems related to centrifugal and reciprocating pumps, and understand hydraulic systems and fluidics.

Course Outcomes

Upon successful completion of the course, the student will be able to

CO1: Discuss fluid properties, **find** the pressure/pressure difference of fluid flowing in pipe/pipes by using various manometers and **illustrate** flow fields. {**Apply level, KL3**}

CO2: Apply Bernoulli's equation to flow measurement devices and **compute** pipe flow losses. {**Apply level, KL3**}

CO3: Estimate lift and drag on geometrical bodies and **compute** forces exerted by jets on vanes. {**Apply level, KL3**}

CO4: Compute the performance of Hydraulic turbines. {**Apply level, KL3**}

CO5: Analyze the performance of centrifugal and reciprocating pumps and **understand** the hydraulic systems and fluidics. {**Analyze level, KL4**}

UNIT-I

BASIC CONCEPTS & FLUID PROPERTIES: Definition of fluid, differences between a solid and fluids, physical properties of fluids- specific gravity, viscosity, surface tension, capillarity, vapor pressure. **(02 hrs)**

PRESSURE & FLUID STATICS: Pascal's law for pressure at a point, pressure variation in a fluid at rest, Absolute, gauge, Atmospheric and vacuum pressures, measurement of pressure, Manometers - Piezometer, U-tube, inverted and differential manometers. **(04 hrs)**

FLUID KINEMATICS: Introduction, classification of flows, steady & un steady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows, equation of continuity for one dimensional flow, Stream line, path line, streak lines and stream tube, Stream function, velocity potential function, differences and relation between them, condition for irrotational flow. **(04 hrs)**

UNIT-II

FLUID DYNAMICS: Surface & body forces, Euler's & Bernoulli's equations for flow along a stream line, momentum equation and its applications on force on pipe bend, Measurement of flow: pitot tube, venture meter and orifice meter, flow nozzle. **(05 hrs)**

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, power transmission through pipes. **(05 hrs)**

UNIT-III

BOUNDARY LAYER CONCEPTS: Definition, thicknesses, characteristics along thin plate, Definition of displacement, momentum, energy thickness, separation of boundary layers, Fluid flow around submerged objects, concepts of drag and lift, expression for drag and lift, types of drag, Streamlined body and bluff body. **(05 hrs)**

Impact of Jets: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes. **(05 hrs)**

UNIT-IV

Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube- theory functions and efficiency. **(05 hrs)**

Performance of hydraulic turbines: Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. **(05 hrs)**

UNIT- V

Centrifugal pumps: Classification, working principle, work done, different heads in a pumping system, different efficiencies of a centrifugal pump, specific speed, pumps in series and parallel, performance characteristic curves. **(05 hrs)**

Reciprocating pumps: Working principle, types, Discharge and power requirement, slip, coefficient of discharge. **(02 hrs)**

Hydraulic systems: Hydraulic ram, hydraulic lift, hydraulic coupling. **(02 hrs)**

Fluidics**: Amplifiers, Sensors and Oscillators. **(01 hr)

Text books:

1. Hydraulics and Fluid mechanics including Hydraulic machinery MODI and SETH, Standard Book house publications.
2. Fluid Mechanics: Fundamentals and Applications by Y.A. Cengel & J.M.Cimbala, 6th Edn, Mc GrawHill.

Reference books

1. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand Publications, Sixth Edition.
2. RK Bansal, Fluid Mechanics and Hydraulic Machines, 10/e, Laxmi Publications(P)Ltd, 2019.
3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons, Nineth Edition
4. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International, 2007.
5. Hydraulic Machines by Banga & Sharma, Khanna Publishers, Eighth Edition.
6. Fluid Mechanics & Turbo machinery by Dixon, 7th Edn, Elesvier
7. Fluid Mechanics and Hydraulic Machines by Domkundwar & Domkundwar, Dhanpatrai & Co.

e- Resources & other digital material

1. https://nptel.ac.in/courses/112/105/112105171/
2. https://nptel.ac.in/courses/112/105/112105183/
3. https://nptel.ac.in/courses/105/101/105101082/
4. https://nptel.ac.in/courses/105/103/105103095/

II Year II Semester	THEORY OF MACHINES	L 3	T 0	P 0	C 3

Pre-Requisites:

1) Engineering Mathematics

2) Engineering Mechanics

Course objectives: The objectives of the course are to make the students learn about

- Introduce various basic mechanisms and their applications.
- Explain importance of degree of freedom.
- Familiarize velocity and acceleration in mechanisms.
- Describe the cams and follower motions.
- Explain the importance of gyroscopic couples.
- Introduce the equation of motion for single degree of freedom system.

Course outcomes:

Upon successful completion of this course the student should be able to:

CO1: Understand different mechanisms and their inversions. (L2)
CO2: Calculate velocity and acceleration of different links in a mechanism. (L3)
CO3: Apply the effects of gyroscopic couple in ships, aeroplanes and road vehicles. (L3)
CO4: Illustrate the working of various governors and fly wheels. (L3)
CO5: Execute the methods of balancing rotary masses and understand free and damped vibrations of single degree freedom systems. (L3)

UNIT-I

Simple Mechanisms: Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains

Mechanisms with lower pairs: Exact and approximate copiers and generated types – Peaucellier, Hart and Scott Russel – Grasshopper – Watt T. Chebicheff and Robert Mechanisms and straight-line motion, Pantograph.

Conditions for correct steering – Davis Steering gear, Ackerman's steering gear mechanism.

UNIT-II

Kinematics of Mechanisms: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method –Velocity and acceleration analysis of for a given mechanism, Coriolis acceleration, determination of Coriolis component of acceleration

Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology –Types of follower motion- Knife edge, Roller and Flat faced followers during Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and acceleration during outward and return strokes in the above 3 cases. Analysis of motion of followers**.**

UNIT-III

Kinematics of gears: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting expressions for arc of contact and path of contact.

Gyroscope: Principle of gyroscope, gyroscopic effect in an Aero plane, ship, car and two-wheeler, simple problems

UNIT-IV

Governors: Watt, porter and proell governors, spring loaded governors Hartnell and Hartung- sensitiveness, isochronism and hunting.

Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design,

UNIT-V

Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses in different planes, using graphical methods.

Vibrations: Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems,

Text Books:

1. S.S.Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

Reference Books:

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J.: Prentice Hall, 1993.

e- Resources & other digital material:

1. https://nptel.ac.in/courses/112/102/112102284/
2. https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-ce17/
3. https://onlinecourses.nptel.ac.in/noc20_me84/preview
4. https://www.youtube.com/watch?v=kpAnsW-WB58

II Year	FLUID MECHANICS & HYDRAULIC	L	T	P	C
II Semester	MACHINERY LAB	0	0	3	1.5

Pre-Requisites: Nil

Course objectives: To impart practical exposure on the various flow measuring equipment, performance evaluation methods of hydraulic turbines and pumps.

Course Outcomes: After completion of the course students are able to:

CO1: Apply Bernoulli's principle in determining the coefficient of discharge of various flow meters. {**Apply Level**}

CO2: Apply the knowledge in verification of fluid flow and estimate the friction factor and loss of head due to sudden contraction in a pipe line. {**Apply Level**}

CO3: Apply Impulse Momentum principle in estimation of the force excerted by jet on a fixed flat plate. {**Apply Level**}

CO4: Develop capability to apply conservation principles to hydraulic machines. {**Apply Level**}

LIST OF EXPERIMENTS:

(At least 10 Experiments are required to be conducted)

1. Calibration of Venturimeter.
2. Calibration of Orifice meter.
3. Determination of friction factor for a given pipe line.
4. Determination of loss of head due to sudden contraction in a pipeline.
5. Turbine flow meter.
6. Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Francis Turbine.
9. Performance Test on Kaplan Turbine.
10. Performance Test on Single Stage Centrifugal Pump.
11. Performance Test on Multi Stage Centrifugal Pump.
12. Performance Test on Reciprocating Pump.

REFERENCE: Lab Manual

Virtual Lab:

1. To study different patterns of a flow through a pipe and correlate them with the Reynolds number of the flow. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/introduction.html)
2. To calculate Total Energy at different points of venture meter. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/introduction.html).
3. To calculate the flow (or point) velocity at center of the given tube using different flow rates. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/pitot/introduction.html)
4. To determine the hydrostatic force on a plane surface under partial submerge and full submerge condition. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/cop/introduction.html).
5. To determine the discharge coefficient of a triangular notch. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/introduction.html)
6. To determine the coefficient of impact of jet on vanes. (https://fm-nitk.vlabs.ac.in/exp/impact-of-jet).
7. To determine friction in pipes. (https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/index.html).

II Year	MANUFACTURING PROCESSES LAB	L	T	P	C
II Semester		0	0	3	1.5

Course Objective: Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics.

Course Outcomes:

CO1: Make moulds for sand casting. (L2)

CO2: Fabricate different types of components using various manufacturing techniques. (L2)

CO3: Adapt unconventional manufacturing methods. (L3)

CO4: Develop Different Weld joints. (L6)

CO5: Explain different types of 3d Printing techniques. (L2)

List of Experiments

1. Design and making of pattern
   i. Single piece pattern
   ii. Split pattern
2. Sand properties testing
   i. Sieve analysis (dry sand)
   ii. Clay content test
   iii. Moisture content test
   iv. Strength test (Compression test & Shear test)
   v. Permeability test
3. Mould preparation
   i. Straight pipe
   ii. Bent pipe
   iii. Dumble
   iv. Gear blank
4. Gas cutting and welding
5. Manual metal arc welding
   i. Lap joint
   ii. Butt joint
6. Injection Molding
7. Blow Molding
8. Simple models using sheet metal operations
9. Study of deep drawing and extrusion operations

10. To make weldments using TIG/MIG welding
11. To weld using Spot welding machine
12. To join using Brazing and Soldering
13. To make simple parts on a 3D printing machine
14. Demonstration of metal casting.

Virtual Lab:

1. To study and observe various stages of casting through demonstration of casting process. (https://virtual-labs.github.io/exp-sand-casting-process-dei/theory.html)
2. To weld and cut metals using an oxyacetylene welding setup. (https://virtual-labs.github.io/exp-gas-cutting-processes-iitkgp/index.html).
3. To simulate Fused deposition modelling process (FDM) (https://3dpdei.vlabs.ac.in/exp/simulation-modelling-process)
4. https://altair.com/inspire-mold/
5. https://virtual-labs.github.io/exp-simulation-cartesian-system-dei/theory.html

II Year	THEORY OF MACHINES LAB	L	T	P	C
II Semester		0	1	2	2

Course Objectives: The Students will acquire the knowledge

To analyze gyroscope, frequency of free and forced vibration and study static and dynamic balancing and also whirling of shafts.

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: Analyze the motion of a motorized gyroscope when the couple is applied along its spin axis **(Analyse level, KL-3)**

CO2: Test the frequency of undamped and damped free vibration of an equivalent spring mass system **(Analyse level, KL-4)**

CO3: Compute the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation **(Apply level, KL-3)**

CO4: Analyze the static and dynamic balancing using rigid blocks, moment of inertia of a flywheel and whirling speed of shaft (**Analyse KL-4)**

List of experiments:

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis.
4. To determine the frequency of undamped free vibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel.
8. To plot follower displacement vs cam rotation for various Cam Follower systems.

9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage, velocity ratio and efficiency
12. To study various types of gears- Spur, Helical, Worm and Bevel Gears

II Year	DESIGN THINKING & INNOVATION	L	T	P	C
II Semester		1	0	2	2

Course Objectives: The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

UNIT – I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT – V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview