

**TKR COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)**

(Accredited by National Board of Accreditation)

ACADEMIC REGULATIONS FOR THE YEAR 2017-2018

&

**SYLLABUS FOR DEPARTMENT OF
MECHANICAL ENGINEERING**



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T.K.R COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

ACADEMIC REGULATIONS FOR B.TECH. R17 (REGULATIONS)

APPLICABLE FOR REGULAR STUDENTS OF B.TECH. WITH EFFECT FROM ACADEMIC YEAR 2017-2018.

1.0 Under-Graduate Degree Programme in Engineering & Technology (UGP in E & T)

1.1 T K R College of Engineering & Technology (TKRCET) offers a VIII-Semesters or (4-year) **Bachelor of Technology (B.Tech.)** degree programme, under Choice Based Credit System (CBCS) at its Autonomous College with effect from the academic year 2017-2018 in the following branches of Engineering:

S.No.	Branch
1.	Civil Engineering
2.	Electrical & Electronics Engineering
3.	Mechanical Engineering
4.	Electronics & Communication Engineering
5.	Computer Science & Engineering
6.	Information Technology

2.0 Eligibility for admission

2.1 Seats in each programme in the college are classified into CATEGORY-A (70% of intake), CATEGORY-B (30% of intake) and CATEGORY-C (20% of intake) as Lateral Entry.

2.2 Admission to the CATEGORY-A (70% of Intake) shall be made either on the basis of the merit rank obtained by the qualified candidate in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the government from time to time.

2.3 CATEGORY-B (30% of Intake) will be filled by the college as per the guidelines of the Competent Authority.

2.4 CATEGORY-C (20% of intake) as Lateral Entry students into the course shall be admitted to the third semester directly based on the rank secured by the candidate in Engineering

Common Entrance Test (ECET) in accordance with the instructions received from the convener, ECET and competent authority.

2.5 The medium of Instructions for the entire under graduate programme in Engineering & Technology will be **English** only.

2.6 **It is mandatory for every student to go with an undertaking that he will follow and abide by the rules of T K R College of Engineering & Technology.**

3.0 B.Tech. Programme structure

3.1 A Student after securing admission shall pursue the under graduate programme in B.Tech for a minimum period of VIII-semester, (4 academic years) and a maximum period of 8 academic years starting from the date of commencement of first semester, failing which the student shall forfeit seat in B.Tech course. **Each semester is structured to provide 24 credits from I semester to IV semester and 27 credits from V semester to VII semester, and VIII semester with 24 credits totaling to 201 credits** for the entire B.Tech. Programme.

Each student shall secure 192 credits (with CGPA ≥ 5.0) required for the completion of the undergraduate programme and award of B.Tech. Degree.

A Student who opts for 27 credits from V semester to VII semester, is permitted to drop the professional electives of VIII semester by satisfying the requisite award of CGPA ≥ 8.0 and secure minimum number of required credits till completion of VII semester.

3.2 **UGC/AICTE** specified definitions/descriptions are adopted appropriately for various terms and abbreviations used in these academic regulations/norms, which are listed below.

3.2.1 Semester scheme

Each under graduate programme is of VIII semesters (4 academic years) with academic year being divided into two semesters. Each Semester will have maximum of 22 weeks and a minimum of 18 weeks i.e., (≥ 90 instructional days). Each semester will have “Continuous Internal Evaluation (CIE)” and “Semester End Examination (SEE)”. Choice Based Semester System (CBSS) is implemented as given by UGC and curriculum/course structure as suggested by AICTE, which are followed from time to time.

3.2.2 Credit Courses

All subjects/courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/course in an L: T: P: C (lecture periods: tutorial periods: practical periods: credits) structure based on the following general pattern.

- One credit for one Period/hour/week/semester for theory/lecture (L) courses.
- One credit for two Periods/hours/week/semester for laboratory/practical (P) courses or tutorials (T).

Courses like Environmental Science, Professional Ethics, Gender Sensitization lab and other student activities like NCC/NSO and NSS are identified as mandatory courses. These courses will not carry any credits.

3.2.3 Subject-Course Classification

All courses offered for the under graduate programme in E & T (B.Tech. degree programmes) are following all the guidelines issued by AICTE/UGC, in implementing the course classification for Choice Based Credit System are as given in the below table. The Classification is made with the following nomenclatures The Foundation Course (FnC), Core Courses (CoC), Elective Courses (EIC), Minor Courses (MrC) and Mandatory Courses.

S. No.	Classification		Course Work - Subject Area	Range of Total Credits (%)	
	AICTE	UGC		Min	Max
1	HS	Foundation Courses	Humanities and Social Sciences including	5	10
2	BS		Basic Sciences(BS) including Mathematics, Physics, Chemistry, Biology;	15	20
3	ES		Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/ Electronics/ Mechanical/Computer Engineering	15	20
4	PC	Core Courses	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required	30	40
5	PW		Project Work, Seminar and/or Internship in Industry or elsewhere.	10	15
6	PE	Elective Courses	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch;	10	15
7	OE		Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	5	10

3.2.4 Subject Code Classification

The Subject Codes of various branches in R17 Regulations are formulated using the following Procedure

“Regulation, Branch, Semester, AICTE Classification, S.No.”

Regulation

Will hold its nomenclature with capital Alphabets A-Z i.e., R17-A,R18-B,R19-C...so on.

Branch**UG Branch:**

1-Civil Engineering; 2-Electrical & Electronics Engineering; 3-Mechanical Engineering; 4-Electronics & Communication Engineering; 5-Computer Science & Engineering; 6-Information Technology;

PG Specialization with Branch:

12-Power Electronics; 25- Computer Science & Engineering; 35-Software Engineering; 14-Master of Business Administration.

Semester: 1, 2,3,4,5,6,7,8.

AICTE Classification:

HS (Humanities & Sciences); BS (Basic Sciences); ES (Engineering Sciences); PC (Professional Core); PE (Professional Elective); PW (Project Work); OE (Open Elective);

S.No: it indicates the number of subjects offered in that semester from 1-9.

Example:

A21BS3 this is subject code for Engineering Physics-I of I semester Electrical & Electronics Engineering of UG Course; Wherein **A** is the R17 Regulation; **2** is the branch code of Electrical & Electronics Engineering; **1** is the Semester; **BS-** is the AICTE Classification given for Engineering Physics-I; **3** is the S.No. of the Subject in that semester.

4.0 Course registration

- 4.1 A 'faculty advisor or counselor' shall be assigned to a group of 20 students, who will advise students about the under graduate programme, its course structure and curriculum, choice/option for subjects/courses, based on their competence, progress, pre-requisites and interest.
- 4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through 'on-line registration' ensuring 'date and time stamping'. The on-line registration requests for any 'current semester' shall be **completed before the commencement of SEE s (Semester End Examinations) of the 'preceding semester'**.
- 4.3 A student can apply for on-line registration, **only after** obtaining the written approval from faculty advisor/counselor, which should be submitted to the college academic section through the Head of the Department. A copy of the same shall be retained with Head of the Department, faculty advisor/counselor and the student.
- 4.4 **A student is offered with an extra credit Course in V VI VII semesters under choice based credit system.**

- 4.5 A student is permitted to register for 8 subjects/courses with respect to 5-6 theory subjects/course and 3-2 practical subjects/courses for every semester.
- 4.6 If the student submits ambiguous choices or multiple options or erroneous entries during on-line registration for the subject(s)/course(s) under a given/specified course group/category as listed in the course structure, only the first mentioned subject/course in that category will be taken into consideration.
- 4.7 Subject/course options exercised through on-line registration are final and **cannot** be changed or inter-changed; further, alternate choices also will not be considered. However, if the subject/course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the head of the department, with due notification and time-framed schedule, within the **first week** after commencement of class-work for that semester.
- 4.8 **Open electives:** The students have to choose one open elective (**OE-I**) in **V semester**, one (**OE-II**) in **VI semester**, (**OE-III**) in **VII semester** from the list of open electives given. However, the student cannot opt for an open elective subject offered by their own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.
- 4.9 **Professional electives:** students have to choose professional elective (**PE-I**) in **V semester**, (**PE-II,III**) in **VI Semester**, professional electives (**PE-IV,V,VI**) in **VII semester**, Professional electives (**PE-VII,VIII,IX**) in **VIII semester**, form the list of professional electives given. However, the students may opt for professional elective subjects offered in the related area.

5.0 Subjects/courses to be offered

- 5.1 A typical section (or class) strength for each semester shall be 60.
- 5.2 A subject/ course may be offered to the students, only if a minimum of 20 students (1/3 of the section strength) opt for it. The maximum strength of a section is limited to 80 (60 + 1/3 of the section strength).
- 5.3 More than **one faculty member** may offer the **same subject** (lab/practical may be included with the corresponding theory subject in the same semester) in any semester. However, selection of choice for students will be based on – ‘**first come first serve** basis and CGPA criterion’ (i.e. the first focus shall be on on-line entry from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student)
- 5.4 If more entries for registration of a subject come into picture, then the Head of Department concerned shall decide, whether or not to offer such a subject/ course for **two (or multiple) sections**.

- 5.5 An Elective Course is offered to the students if and only if a minimum of 1/3 strength of the sanctioned intake is opted.

6.0 Attendance requirements

- 6.1 A student shall be eligible to appear for the semester end examinations, if student acquires a minimum of 75% of attendance in aggregate of all the subjects/courses including days of internal examinations (excluding attendance in mandatory courses; Environmental Science, Professional Ethics, Gender Sensitization Lab, NCC and NSS) for that semester.
- 6.2 For Mandatory Courses like NCC and NSS a 'Satisfactory Participation Certificate' shall be issued to the students from the authorities concerned only after securing $\geq 65\%$ attendance in such a course. Also, submission of Report on the activities is mandate for securing attendance during the allocated periods.
- 6.3 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the college academic committee on valid grounds, like Natural Calamity, Medical Emergency, any sudden demise of own family members based on the students representation with supporting evidence/certificates.
- 6.4 A stipulated fee shall be payable towards condoning of shortage of attendance.
- 6.5 Shortage of attendance **below 65%** in aggregate shall, **in no case be condoned.**
- 6.6 **Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester.**
- 6.7 The students who are detained due to lack of attendance should seek re-admission into that semester as and when offered, and re-register all the courses offered in that semester.
- 6.8 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class, till completion of VIII semester, even on payment of requisite fees.

7.0 Academic requirements

The following academic requirements have to be satisfied, **in addition to the** attendance requirements mentioned in item no 6.

- 7.1 A student shall be deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each subject/course, secures not less than **35% marks (24 out of 70)** in the semester end examination, and a minimum of **40%** of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that subject/course.
- 7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to UG mini-project and seminar, if student secures not less than **50%**

marks (i.e. 50 out of 100 marks) in each of them. The student would be treated as failed, if student (i) does not submit a report on UG mini-project, or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar as required in the VII semester, or (iii) secures less than 50% marks in UG mini-project/seminar evaluations.

Student may reappear once for each of the above evaluations, when they are scheduled again; if student fails in such ‘one reappearance’ evaluation also, student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules:

S.No.	Promotion	Conditions to be fulfilled
1.	I semester to II semester	The student should study Regular course of I semester by satisfying attendance requirements.
2.	II Semester to III Semester	The student should study Regular course of II Semester, by satisfying attendance requirements. and also the student should secure at least 24 credits out of 48 credits i.e., 50 % credits II Semester from all the regular and supplementary examinations which are relevant to him, whether the student takes those examinations or not.
3.	III Semester to IV Semester	Regular course of study of III Semester, by satisfying attendance requirements.
4.	IV Semester to V Semester	Regular course of study of IV semester, by satisfying attendance requirements, and must have secured at least 58 credits out of 96 credits i.e., 60% credits up to IV semester from all the relevant regular and supplementary examinations, whether the students takes those examinations or not.
5.	V Semester to VI Semester	Regular course of study of V Semester, by satisfying attendance requirements.

6	VI Semester to VII Semester	Regular course study of VI semester, by satisfying attendance requirements. Must have secured at least 86 credits out of 144 credits i.e., 60 % credits up to VI Semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	VII Semester to VIII Semester	Regular course of study of VII Semester, by satisfying attendance requirements.

Promotion Rules for Lateral Entry Students

S.No.	Promotion	Conditions to be fulfilled
01	III Semester to IV Semester	Regular course of study of Second Year first semester, by satisfying attendance requirements
02	IV Semester to V Semester	Regular course of study of IV Semester by satisfying attendance requirements and a minimum of 17 credits from one regular and one supplementary examinations of III semester irrespective of the candidate takes the examination or not.
03	V Semester to VI Semester	Regular Course of Study of V Semester by satisfying attendance requirements
04	VI semester to VII Semester	Regular Course of study of VI Semester by satisfying academic requirements and a minimum of 50 credits from two regular and two supplementary examinations of III Semester; two regular and one supplementary examinations of IV Semester; one regular and one supplementary examination of V Semester.
05	VII Semester to VIII Semester	Regular course of study of VII Semester by satisfying the academic requirements.

- 7.4 A student shall register for subjects covering 192 credits as specified and listed in the course structure, fulfills all the attendance and academic requirements for 192 credits, 'earn all 192 credits' by securing SGPA ≥ 5.0 (in each semester) and CGPA (at the end of each successive semester) ≥ 5.0 to successfully complete the under graduate programme.
- 7.5 A student who secures 177 credits with an aggregate of 8.0 CGPA is eligible to avail the exemption of registering the three professional electives that are offered in VIII semester only. A student who secures 174 credits with an aggregate of 8.0 CGPA is eligible to avail exemption of registering two professional electives that are offered in VIII semester only. A student who secures 171 credits with an aggregate CGPA of 8.0 is eligible to avail exemption of registering one professional elective offered in VIII semester only. However, the performance of student in the earlier individual semesters, with the corresponding SGPA and CGPA for which grade cards have already been given will not be altered/modified.
- 7.6 If a student registers for some more '**extra subjects**' (in the parent department or other departments/branches of Engg.) other than those listed subjects totaling to 192 credits as specified in the course structure of his department, the performance in those '**extra subjects**' (although evaluated and graded using the same procedure as that of the required 192 credits) will not be taken into account while calculating the SGPA and CGPA. For such '**extra subjects**' registered, % of marks and letter grade alone will be indicated in the grade card as a performance measure, subject to completion of the attendance and academic requirements as stated in regulations 6 and 7.1-7.5 above.
- 7.7 A student eligible to appear in the end semester examination for any subject/course, but absent from it or failed (thereby failing to secure '**c**' grade or above) may reappear for that subject/course in the supplementary examination as and when conducted. In such cases, CIE assessed earlier for that subject/course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.
- 7.8 A student **detained in a semester due to shortage of attendance, may be re-admitted when the same semester is offered in the next academic year for fulfilment of academic requirements.** The academic regulations under which the student has been readmitted shall be applicable. However, no grade allotments or SGPA/CGPA calculations will be done for the entire semester in which the student has been detained.
- 7.9 A student **detained due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which student has been re-admitted shall be applicable to him.

8.0 Evaluation – Distribution and Weightage of marks

- 8.1 The performance of a student in every subject/course (including Practical) will be evaluated for 100 marks each, with 30 marks allotted for CIE (Continuous Internal Evaluation) and 70 marks for SEE (Semester End Examination).

8.2 For theory subjects, during a semester there shall be two mid-term and two minor examinations. Each mid-term examination consists of one objective paper and one descriptive paper carrying 15 marks for descriptive and 5 marks for objective paper with the time duration of 1hour 20 minutes. Each minor examination consists of objective paper/Assignment with 10 marks with a time duration of 60 minutes/one period. The syllabus for first minor examination shall be from unit 1 and first mid examination will be 50% of syllabus. The second minor examination will have syllabus as the partial syllabus from 3rd unit i.e., (2nd half of portion other than covered in mid-1) and 4th unit i.e., 1st half of portion). The syllabus for second mid examination will be remaining 50% of syllabus. The marks secured by the student in each mid-term examination will be evaluated for 20 marks, subsequently each minor examination will be evaluated for 10 marks each. **The total marks secured by the student for the whole CIE (Continuous Internal Evaluation) will be the average of 2 mid-terms and 2 minor examinations.** If any student is absent/ would like to seek improvement from/in any subject of a mid-term examination, an on-line test will be conducted for him by the examination branch of the college, which will be scheduled after completion of both mid-term and minor examinations. The details of the end semester examination question paper pattern is as follows,

- The end semester examinations will be conducted for 70 marks consisting of two parts viz. i) **Part –A** for 20 Marks, ii) **Part –B** for 50 marks.
- Part –A is compulsory question which consists of ten sub-questions. All questions carry equal marks.
- Part-B consists of five questions (number from 2 to 6) carrying 10 marks each. Each of these questions is from one unit and may contain sub questions. For each question there will be an “either” “or” choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

8.3 For practical subjects there shall be a continuous internal evaluation during the semester for 30 marks and 70 marks for end semester practical examinations. The duration for both Internal and External Practical Examination is for 3 hours. For 30 marks of Internal Evaluation of practical subjects, day to day evaluation in laboratory will be assessed for 15 marks and internal practical examination will be assessed for 15 marks. The internal practical examination will be conducted by the concerned laboratory subject teacher (Internal Examiner) only. The external practical examination will have 2 examiners, one is external examiner and the other is internal examiner. The external examiner will be appointed by the examination branch of the college.

8.4 For the subjects having design and/or drawing, (such as engineering graphics, engineering drawing, machine drawing) and estimation, the distribution shall be 30 marks for continuous internal evaluation (15 marks for day to day evaluation and 15 marks for internal examination) and 70 marks for semester end examination. **There shall be two**

internal examinations in a semester and the average of the two shall be considered for the award of marks for internal examinations.

- 8.5** There shall be a UG mini-project work to be undertaken by the student during the break of VI and VII semester. The UG mini-project work should be carried out by student with an Industry of their specialization. The report on completion should be submitted in the starting of Academic year of VII Semester. The report shall be evaluated by departmental committee comprising of external examiner, Head of the Department, project supervisor, and a senior faculty member of the department. There shall be no internal evaluation of UG mini-project. The external Examiner will be appointed by the examination cell.
- 8.6** The student has to undergo a seminar presentation during his VIII semester, and submit a technical report of presentation. For the seminar the student shall collect the information on a specialized topic of their specialization. The submitted technical report will be evaluated by the departmental committee comprising of Head of the Department, seminar supervisor, and a senior faculty member. The technical report will be evaluated for 50 marks. There shall be no internal evaluation for seminar and semester end examination.
- 8.7** The student has to attend the Comprehensive Viva-Voce during VIII Semester. The Comprehensive Viva-Voce shall be conducted by a Committee consisting of Head of the Department and two senior faculty members of the Department. The Comprehensive Viva-Voce is intended to assess the students understanding of the subjects he studied during the B.Tech course of Study. The Comprehensive Viva-Voce is evaluated for 100 marks by the committee, there are no Internal marks for the Comprehensive Viva-Voce
- 8.8** The student during his VIII semester has to register for a UG project, and subsequently get the permission for implementing the project by the departmental committee. The evaluation process of the UG project is done for 200 marks. Out of which 50 marks are allotted for internal evaluation, 150 marks for external evaluation (viva voce). The end semester examination of UG major project shall be conducted by the same committee as appointed for the UG mini-project. In addition the UG major project supervisor shall also be included in the committee. The topics for UG mini-project work, seminar, and major project work shall be different from one another. The evaluation of UG major project will be done at the end of VIII semester.
- 8.9** The laboratory marks, sessional marks, and the end examination marks awarded by the college are subject to scrutiny and scaling, if necessary, by a committee, constituted in this regard, with a university representative/under the guidance of Director of Evaluation of the affiliating university. The recommendations of the committee are final and binding. The laboratory records, internal examination scripts and external examination scripts shall be preserved as per the rules and shall be produced before the committee as and when required.
- 8.10** A student has to secure at least 40% i.e., 40 marks for 100 marks in mandatory courses like environmental science, professional ethics and gender sensitization lab.
- 8.11** For mandatory courses like NCC/NCO, NSS the student should sustain his attendance by participating in the activities of the particular course $\geq 65\%$ as minimum and obtain a 'satisfactory' participation certificate from the concerned authorities.

8.12 For all non-credit courses and mandatory courses no marks or letter grade is allotted.

9.0 Grading Procedure

9.1 Marks will be awarded to the student in order to indicate the performance in each theory subject, laboratory/practicals, seminar, UG mini project and UG major project. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item no. 8 above, a corresponding letter grade shall be given.

9.2 As measure of the performance of a student, a 10-point absolute grading system using the following letter grades (as per UGC/AICTE/JNTUH guidelines) and corresponding percentage of marks shall be followed.

% of marks secured in a subject/course	Letter Grade	Grade Points
90% to 100%	O (Outstanding)	10
80 and less than 90%	A ⁺ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B ⁺ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (Fail)	0
Absent	Ab	0

** Awarding of Letter Grade will be done to the benefit of the student.

9.3 A student obtaining 'F' grade in any subject shall be deemed to have 'failed' and is required to reappear as a 'supplementary student' in the semester end examination, as and when offered. In such cases internal marks in those subjects will remain same as those obtained earlier.

9.4 A student who has not appeared for examination in any subject 'Ab' grade will be allocated in that subject, and student shall be considered 'failed'. Student will be required to reappear as a 'supplementary student' in the semester end examination, as and when offered.

9.5 A letter grade will not indicate any specific percentage of marks, but states only the range of marks he/she obtained.

9.6 A student earned grade point (GP) in each subject/course, on the basis of the letter grade secured in that subject/course. The corresponding 'credit points' (CP) are computed by

multiplying the grade point with credits for that particular subject/course.

Credit points (CP) = grade points (GP) x credits... for a course

9.7 The student passes the subject/course only when **GP ≥ 5 ('C' grade or above)**

9.8 The semester grade point average (SGPA) is calculated by dividing the sum of credit points ($\sum CP$) secured from all subjects/course registered in a semester, by the total number of credits registered during the semester. SGPA is rounded off to **two decimal places**. SGPA is thus calculated as

$$\text{SGPA} = \{\sum_{i=1}^N C_i G_i\} / \{\sum_{i=1}^N C_i\} \dots \text{for each semester,}$$

where 'i' is the subject indicator index (takes into account all subjects, in a semester) 'N' is the no. of subjects registered for the semester (as specifically required and listed under the course structure of the parent department) C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for the i^{th} subject.

9.9 The cumulative grade point average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses in **all** semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded to **two** decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula

$$\text{CGPA} = \{\sum_{j=1}^M C_j G_j\} / \{\sum_{j=1}^M C_j\} \dots \text{for all semesters registered}$$

(i.e., up to and inclusive of S semesters, $S \geq 2$),

where 'M' is the **total** no. of subjects (as specifically required and listed under the course structure of the parent department) the student has '**registered**' i.e., from 1st semester onwards up to and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), c_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade point (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of first year first semester, the SGPA of that semester itself can be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA

Course/subject	Credits	Letter Grade	Grade points	Credit Points
Course1	4	A	8	4 x 8 = 32
Course2	4	O	10	4 x 10 = 40
Course3	4	C	5	4 x 5 = 20
Course4	3	B	6	3 x 6 = 18
Course5	3	A ⁺	9	3 x 9 = 27
Course6	3	B ⁺	7	3 x 7 = 21
	21			158

$$\text{SGPA} = 158/21 = 7.52$$

Illustration of calculation of CGPA:

Course/subject	Credits	Letter Grade	Grade points	Credit Points
I year I semester				
Course1	4	A	8	4 x 8 = 32
Course2	4	O	10	4 x 10 = 40
Course3	4	C	5	4 x 5 = 20
Course4	3	B	6	3 x 6 = 18
Course5	3	A ⁺	9	3 x 9 = 27
Course6	3	B ⁺	7	3 x 7 = 21
II semester				
Course7	4	B	6	4 x 7 = 28
Course8	4	O	10	4 x 10 = 40
Course3	4	C	5	4 x 5 = 20
Course4	3	B	6	3 x 6 = 18
Course5	3	A ⁺	9	3 x 9 = 27
Course6	3	B ⁺	7	3 x 7 = 21
	Total Credits = 42			Total Credit Points = 312

$$\text{CGPA} = 312/42 = 7.42$$

- 9.10** For merit ranking or comparison purposes or any other listing, **only** the ‘**rounded off**’ values of CGPAs will be used.
- 9.11** For calculations listed in regulations 9.6 to 9.9, performance in failed subjects/courses (securing **F grade**) will also be taken into account, and the credits of such subjects/courses will also be included in the multiplications and summations. After passing the failed subjects(s) newly secured grade points will be taken into account for calculation of SGPA and CGPA. However, mandatory courses will not be taken into consideration for calculations of CGPA and SGPA.

10.0 Passing standards

- 10.1** A student shall be declared successful or ‘passed’ in a semester, if student secures a GP ≥ 5 (‘C’ grade or above) in each and every subject/course in that semester (i.e. when student gets an SGPA ≥ 5.00 at the end of that particular semester); and a student shall be declared successful or ‘passed’ in the entire under graduate programme, only when gets a CGPA ≥ 5.00 for the award of the degree as required.
- 10.2** After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. It will show the details of the courses registered (Course code, title, no. of credits, and grade earned etc.), credits earned, SGPA, and CGPA.

11.0 Declaration of results

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 to 9.9

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

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

12.0 Award of degree

12.1 A student who registers for all the specified subjects/courses as listed in the course structure and secures the required number of 192 credits (with CGPA ≥ 5.0), within 8 academic years from the date of commencement of the first academic year, shall be declared to have **'qualified'** for the award of the B.Tech. Degree in the chosen branch of Engineering as selected at the time of admission.

12.2 A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.

12.3 Students with the final CGPA (at the end of the under graduate programme) ≥ 8.00 , and fulfilling the following condition will be awarded **'first class with distinction'**.

"Should have secured a CGPA ≥ 8.00 , for each year of course study consistently and without any fail marks for any subject in any of the semester.

Students with final CGPA (at the end of the under graduate programme) ≥ 6.50 but < 8.00 , shall be placed in **'first class'**.

Students with final CGPA (at the end of the under graduate programme) ≥ 5.50 but < 6.50 , shall be placed in **'second class'**.

Students with final CGPA (at the end of the under graduate programme) ≥ 5.00 but < 5.50 , and all other students who qualify for the award of degree (as per 12.1) with **final CGPA ≥ 5.00 but < 5.50** , shall be placed in **'pass class'**.

A student with final CGPA (at the end of the under graduate programme) < 5.00 , **will not be eligible** for the award of the degree.

12.4 Students fulfilling the conditions listed under 12.3 along with the condition that **at the end of each of the 8 sequential semesters, starting from first year first semester onwards"**. will alone be eligible for award of **'rank'** and **'gold medal'**.

13.0 Withholding of results

13.1 If the student has not paid the fees to the college at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student

may be withheld, and student will not be allowed to go into the next semester. The award or issue of the degree may also be withheld in such cases.

14.0 Transitory regulations

- 14.1 A student who has discontinued for any reason, is liable to completely pay his balance annual fees, from the discontinued year to completion of four year course.
- 14.2 A student who is detained due to lack of credits or lack of attendance has to follow the existing regulations of the year re-admitted, with additional/substitute subjects if necessary.

15.0 Students transfers

- 15.1 There shall be no branch transfers after the completion of admission process.
- 15.2 There shall be no transfers from one college/stream to another within the constituent colleges and units of affiliating university (JNTUH). However if the student is of TKRCET then he is permitted to transfer from Non Autonomous mode to Autonomous mode subjected to the approval of Academic Council of the same affiliating university.
- 15.3 The students seeking transfer under ceiling admission category/special category to this college from any of the JNTUH affiliated Autonomous colleges or from various other Universities/institutions (National Importance, Autonomous) have to pass the failed subjects which are equivalent to the subjects of TKRCET and also pass the subjects of TKRCET which the students have not studied at the earlier institution/university. Further, though the students have passed some of the subjects at the earlier institution/university, if the same subjects are being offered in different semesters of TKRCET, the students have to study those subjects in TKRCET in spite of the fact that those subjects are repeated.
- 15.4 The transferred students from other Universities/institutions to TKRCET, shall be provided a chance of writing online internal examination **for the failed subjects/and or subjects not studied** as per the clearance (equivalence) letter issued by the university/institution, at the end of the semester as per the prescribed schedule by the college examination cell.

16.0 Scope

- 16.1 The academic regulations should be read as whole, for the purpose of any interpretation.
- 16.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman, Governing Body of TKRCET is final.
- 16.3 The College may change or amend the academic regulations, course structure or syllabi, at any time, and the changes or amendments made shall be applicable to all students with effect from the date of notification by the college authorities.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate	
1. (a)	Possesses or carries accessible in the 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 examination 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. The hall ticket of the candidate is to be cancelled.
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.

		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. The candidate is also debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case will be 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. The candidate is also debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk-out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester

	<p>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.</p>	<p>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 will be registered against them.</p>
7.	<p>Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.</p>	<p>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. The candidate is also debarred for two consecutive semesters from class work and all end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.</p>
8.	<p>Possesses any lethal weapon or firearm in the examination hall.</p>	<p>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. The candidate is also debarred and forfeits the seat.</p>

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. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the 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.
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 examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the PRINCIPAL/DIRECTOR for further action to award suitable punishment.	

INSTITUTION

VISION

The Institution endeavours towards imparting quality education with ethical values and strives to make students technically competent to reach high levels of achievements and make our nation self-reliant and globally recognized.

MISSION

The Institution is committed and dedicated to mould the students into quality engineers and technologists with aplomb by providing world class scientific and technical education through:

- Ensuring excellent branch wise infrastructural facilities, with eminent and qualified faculty.**
- Making the institute a research/resource centre to enhance scope for consultancy and R&D.**

DEPARTMENT OF MECHANICAL ENGINEERING

Vision

Mechanical Engineering Department strives to provide quality technical education and prepare the students to become well qualified engineers competent to face global challenges and to serve humanity by acquiring adequate professional knowledge, skill and training.

Mission

The department strives to continually engage in:

- **Ensuring quality teaching- learning process to provide in-depth knowledge of basic concepts, principles and application of processes, tools and equipment pertaining to mechanical engineering and inter-disciplinary areas.**
- **Providing practical training through state-of-art laboratory facilities.**
- **Involving the students in innovative and group work exercises and projects useful for real-life applications.**
- **Preparing the students in developing research, design, entrepreneurial and employability capabilities.**
- **Providing consultancy services and promoting Industry-Department Interactions**
- **Enhancing the Visibility of the Department through seminars and workshops.**

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1:

Provide students with the fundamental technical knowledge and skills in Mathematics, Science, and engineering to recognize analyze and solve problems, and to apply these abilities to the generation of new knowledge, ideas or products in industry or government and to implement these solutions in practice.

PEO2:

Provide students with the necessary instruction and practical experience to work well in local an international team environments and to be effective written and oral communicators, both for communicating ideas to other people, mentoring, and for learning from others.

PEO3:

Produce graduates who recognize the importance of and engage in life-long-learning, whether through self-study, continuing education courses or workshops, or through formal graduate level education and encourage others to have this same motivation.

PEO4:

Produce graduates who have understanding of ethical responsibility and service towards their peers, employers, and society and follow these percepts in their daily lives.

PROGRAMME OUTCOMES (POs)

PO1: An ability to apply knowledge of mathematics, computing, Science engineering fundamentals, and mechanical engineering for the solution of complex engineering.

PO2: Ability to identify, formulate, and solve engineering problems

PO3: An ability to design and develop as model, component, or process to meet desired needs with in constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PO4: An ability to design and conduct experiments, as well as to analyze and interpret

PO5: Select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to broadly defined engineering activities with an understanding of the limitations.

PO6: An understanding of professional, social and ethical responsibility.

PO7: The board education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context for sustainable development.

PO8: Commitment to professional ethics and norms of engineering practice.

PO9: An ability to function on multi-disciplinary teams.

PO10: An ability to exhibit knowledge understanding and application management principles.

PO11: A recognition of the need for, and an ability to engage in life-long learning

PO12: Demonstrate to analyse and apply unconventional processes, automation, robotics Nanotechnology, Computer-Aided Design & Manufacturing and Knowledge in Automobile Engineering, Thermodynamics, Refrigeration & Air Conditioning and Jet Propulsion & Rocket Engineering to analyse and solve complex problems and to work professionally in such systems and plants.



T K R COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous)

B.TECH. MECHANICAL ENGINEERING

I Semester

S.No.	Course Code	Course Title	L	T	P	Credit
1	A31BS1	Mathematics-I	3	1	0	3
2	A31BS2	Mathematics-II	4	1	0	4
3	A31BS3	Engineering Physics	3	0	0	3
4	A31ES4	Computer Programming in C	3	0	0	3
5	A31ES5	Engineering Mechanics	3	0	0	3
6	A31ES6	Engineering Graphics	2	0	4	4
7	A31BS7	Engineering Physics Lab	0	0	3	2
8	A31ES8	Computer Programming in C Lab	0	0	3	2
9	AMC01	NSS	0	0	0	0
		Total	21	2	10	24

II Semester

S.No.	Course Code	Course Title	L	T	P	Credit
1	A32BS1	Applied Physics	3	1	0	3
2	A32BS2	Engineering Chemistry	4	1	0	4
3	A32BS3	Mathematics-III	4	1	0	4
4	A32HS4	Professional Communication in English	3	0	0	3
5	A32ES5	Basic Electrical & Electronics Engineering	2	0	4	4
6	A32BS6	Engineering Chemistry Lab	0	0	3	2
7	A32HS7	English Communication Skills Lab	0	0	3	2
8	A32ES8	Engineering Workshop	0	0	3	2
9	AMC02	NCC/NSO	0	0	0	0
		Total	16	3	13	24

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

Department of MECHANICAL ENGINEERING

MATHEMATICS-I

SEMESTER - I

Subject code: A31BS1

L/T/P C

3/1/0/ 3

Course Objectives:

To learn

1. The concept of rank of a matrix and applying the same to understand the consistency and Solving them.
2. The concept of Eigen values and Eigen vectors and reducing the quadratic forms in to their canonical forms.
3. Methods of solving the linear differential equations of first and higher order.
4. Partial differentiation, concept of total derivative.
5. Finding maxima and minima of a function of two variables.

Course Outcomes:

Upon Completion of the subject, students will be able to,

1. Write the matrix representation of a set of linear equations and to analyse the solution of a system of equations.
2. Find the Eigen values and Eigen vectors which come across under linear transformations.
3. Find the external values of a function of two variables with and without constraints.
4. Solve higher order Differential Equations and apply them for solving some real world problems.
5. Represent a function in series form using Maclaurins series.

UNIT I

Linear Systems of Equations:

Rank, Echelon form, normal form, consistency and solution of linear systems, Gauss elimination, Gauss-Jordon and LU decomposition method.

Applications:

Finding Current in Electrical Circuits.

UNIT II

Eigen values, Eigen Vectors and Quadratic Forms:

Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem, Inverse and powers of a matrix using Cayley-Hamilton theorem, diagonalization, Quadratic forms, reduction of QF to Canonical form, rank and nature of the QF-Index and Signature.

UNIT III

Initial Value Problems and Applications:

First order Linear Differential Equations, Bernoulli's Differential Equations.

Applications:

Newton's Law of Cooling, Law of Natural Growth and Decay, Orthogonal Trajectories.

Linear Differential Equations of higher order with constant coefficients:

Non Homogeneous Terms with RHS of the type e^{ax} , $\sin ax$, $\cos ax$, polynomials in X , $e^{ax} V(X)$, $X V(X)$, Wronskian of functions Method of variation of parameters.

Applications: Electrical Circuits.

UNIT IV

Differential Calculus:

Mean Value Theorems-Rolle's Theorem - Lagrange's mean value theorem - Cauchy's mean value theorem - Generalized mean value theorem (all theorems statements and their verification). Taylor's series and Maclaurin's series, Taylors and Maclaurin's series expansion of functions of two variables.

UNIT V

Partial Differentiation:

Introduction of partial differentiation, homogeneous function, Euler's theorem, total derivative, chain rule, functional dependence, Jacobian.

Applications:

Maxima and Minima of functions of two variables without constraints and Lagrange's method.

Text Books:

1. A first course in differential equations with modeling applications by Dennis G. Zill, Cengage Learning publishers.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers.

Reference Books:

1. Advanced Engineering Mathematics by E. Kreyszig, John Wiley and Sons Publisher.
2. Engineering Mathematics by N. P. Bali, Lakshmi Publications.
3. Differential calculus by Shanti Narayan, S.Chand and Company publications.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

Department of MECHANICAL ENGINEERING

MATHEMATICS-II

SEMESTER - I

Subject code: A31BS2

L/T/P C

4/1/0/ 4

Course Objectives:

1. Evaluation of Integrals using Beta and Gamma functions.
2. Evaluation of multiple integrals and applying them to compute the volume and area of regions.
3. The physical Quantities involved in Engineering field related to the vector valued functions.
4. The basic properties of vector valued functions and their applications to line, surface and volume integrals.
5. Concepts and properties of Laplace Transforms and solving DE using Laplace Transforms Techniques.

Course Outcomes:

Upon completion of the subject, students will be able to

1. Use Laplace Transform Techniques for solving DE's.
2. Evaluate integrals using Beta and Gamma functions.
3. Evaluate The Multiple Integrals and can apply these concepts to find areas, volumes, moment of inertia etc. of regions on a plane or in space.
4. Evaluate the Line, surface and volume integrals and converting them from one to another.

UNIT I

Beta and Gamma functions:

Beta and Gamma functions, properties, relation between Beta and Gamma functions, Evaluation of integrals using Beta and Gamma functions.

Applications:

Evaluation of Integrals.

UNIT II

Multiple Integrals:

Double and triple Integrals, change of variables, change of order of integration

Applications:

Finding areas, volumes and center of gravity (evaluation using Beta and Gamma functions).

UNIT III

Vector Differentiation:

Scalar and Vector point functions, Gradient, Divergence, Curl and their Physical and geometrical Interpretation, Laplacian operator, vector identities.

UNIT IV

Vector Integration:

Line integral, work done, potential function, area, surface and volume integrals, and vector integral theorems: Green's, Stoke's and Gauss divergence theorems (without proof) and related problems.

UNIT V

Laplace Transforms:

Laplace transforms of standard functions, shifting theorems, derivatives and integrals, properties unit step function, Dirac's delta functions, periodic functions, Inverse Laplace transforms, convolution theorem (without proof).

Applications:

Solving Ordinary Differential Equations (Initial Value Problems) using Laplace Transforms.

Text Books:

1. Advanced Engineering Mathematics by R.K.Jain and S R K Iyengar, Narosa publishers.
2. Engineering Mathematics by Srimantha Pal and Subodh C.Bhunia, Oxford publishers.

Reference books:

1. Advanced Engineering Mathematics by V.O.Neil, Cengage learning Publishers.
2. Mathematics by Lawrence Turyn, CRC Press.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

Department of MECHANICAL ENGINEERING

Engineering Physics

SEMESTER - I

Subject code: A31BS3

L/T/P C

3/0/0/ 3

Course Objectives:

1. To understand interaction of light with matter through interference, diffraction and polarization.
2. To able to distinguish ordinary light with a laser light and to realize propagation of light through optical fibers.
3. To understand various crystal systems and their structures elaborately.
4. To study various crystal imperfections and probing methods like X-RD.

Course outcomes:

The student is able to

1. Realize the importance of light phenomena in thin films and resolution.
2. Learn principle, working of various laser systems and light propagation through optical fibers.
3. Distinguish various crystal systems and understand atomic packing factor.
4. Know the various defects in crystals.

UNIT I

Interference:

Coherence, division of amplitude and division of wave front, interference in thin films (transmitted and reflected light), Newton's rings experiment.

Diffraction:

Distinction between Fresnel and Fraunhofer diffraction, diffraction due to single slit, N-slits, Diffraction grating experiment.

UNIT II

Polarization:

Introduction, Types of polarization, Brewster's law, Malus's law, double refraction, Nicol prism, Quarter wave and half wave plates.

Lasers:

Characteristics of lasers, spontaneous and stimulated emission of radiation, Einstein coefficients, population inversion, components of laser, ruby laser, helium – neon laser, semi-conductor laser, applications of lasers.

UNIT III

Fiber Optics:

Principle of optical fiber, construction of fiber, acceptance angle and acceptance cone, numerical aperture, types of optical fibers: step index and graded index fibers, attenuation in optical fibers, applications of optical fibers in medicine and sensors and optical communication system.

UNIT IV

Crystallography:

Space lattice, unit cell and lattice parameters, crystal systems, Bravais lattices, atomic radius, co-ordination number and packing factor of SC, BCC, FCC, HCP and diamond, Miller indices, crystal planes and directions, inter planar spacing of orthogonal crystal systems.

UNIT V

X-ray Diffraction of crystal plane:

Bragg's law, X-ray diffraction methods: Laue method, powder method.

Defects in crystals:

Point defects: vacancies, substitutional, interstitial, Frenkel and Schottky defects, line defects (qualitative) and Burger's vector, surface defects: stacking faults, twin, tilt and grain boundaries and volume defects.

Text Books:

1. Engineering Physics Vol-I, K. Vijaya Kumar and S. Chandra Lingam, S. Chand and Co. Pvt. Ltd.
2. Engineering Physics-I, P.K.Palanisamy, Scitech Publications (INDIA) PVT LTD.
3. Engineering Physics, Dr.S.L.Gupta, Sanjeev Gupta, Dhanapat Rai Publications (P) LTD.
4. Introduction to Solid State Physics, Charles Kittel, Wiley Student edition.

Reference Books:

1. Physics Vol. 2, Halliday, Resnick and Kramer John wiley and Sons, Edition 4.
2. Waves, Frank S Crawford Jr, Berkeley Physics course, Volume 3.
3. Solid State Physics, AJ Dekker, Mac Milan Publishers.
4. Engineering Physics, K. J. Pratap, et.al, New Age International Publishers.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

Department of MECHANICAL ENGINEERING

Computer Programming in C

SEMESTER - I

Subject code: A31ES4

L/T/P C

3/0/0/ 3

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in programme development.
3. To learn the syntax and semantics of C Programming Language.
4. To learn how to write modular and readable c Programmes.
5. To learn to write programmes using structured programming approach in c to solve problems.

Course Outcomes:

Upon completion of course the student will be able to

1. Demonstrate the basic knowledge of computer hardware and software.
2. Write algorithms for solving problems.
3. Draw flow charts for solving problems.
4. Code a given logic in C programming language.
5. Gain knowledge in using C language for solving problems.

UNIT I

Introduction to Computers,

Data Representation, Number Systems, Computer Languages, Algorithms.

Introduction to C Language:

Data types, Operators, Expressions, Statements-Selection Statements – if and Switch Statements, Repetition (Loop) statements. Creative exercises.

UNIT II

Fundamentals of Data structures:

Linear and Non-Linear data structures, concepts of stacks and queues.

Arrays:

One and two dimensional arrays, multidimensional arrays, inter function communication Arrays-applications- linear search, binary search, bubble sort, Implementation of stacks and queues. Creative exercises.

UNIT III

Functions:

Scope and Extent, storage classes, recursive functions

Pointers:

Introduction, Pointers for inter function communication, arrays of pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, pointers to functions. Pointers to pointers.

Creative exercises

UNIT IV

Strings:

Concepts, String Input/ Output functions, arrays of strings, string manipulation functions.

Enumerated types:

Structure and Unions. Initialization, accessing structures, operations on structures. Complex structures-Nested structures, structures containing arrays, structures containing pointers, arrays of structures, structures and functions, Passing structures through pointers, self-referential structures, unions, bit fields, C programming examples, command-line arguments, pre-processor commands.

Creative Exercises

UNIT V

Input and output:

Concept of a file, streams, text files and binary files, file input/output functions (standard library input/output functions for files), error handling, positioning functions (fseek, rewind and ftell).

Case studies:

Scientific Calculator, student Information system, Employee information system, Search and Retrieval, Gaming.

Text Books:

1. Computer Science: A Structured Programming Approach Using C, B. A. Forouzan and R.F.Gilberg, Third Edition, Cengage Learning.
2. Programming in C. P. Dey and M Ghosh, Second Edition, Oxford University Press.

Reference Books:

1. The C Programming Language, B.W. Kernighan and Dennis M. Ritchie, Second Edition, Pearson education.
2. Programming with C, B. Gottfried, 3rd edition, Schaum's outlines, McGraw Hill Education (India) Pvt. Ltd.
3. C from Theory to Practice, G S. Tselikis and N D. Tselikas, CRC Press.
4. Basic computation and Programming with C, Subrata Saha and S. Mukherjee, Cambridge University Press.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

Department of MECHANICAL ENGINEERING

Engineering Mechanics

SEMESTER-I

Subject code: A31ES5

L/T/P C

3/0/0/ 3

Course Objectives:

- To understand the resolving forces and moments for a given force system.
- To understand the representation of forces and momentum in a force system, by vectors and scalars and solve the system of forces and moment by use of mathematics.
- To analyze the types of friction for moving bodies and problems related to friction.
- To determine the centroid and second moment of area.
- To analyze the properties of plain and solid surfaces in relation to moment of Inertia.
- To illustrate the laws of motion, kinematics of motion and their relation.

Course outcomes:

- Ability to resolve the force system in structural constructions.
- Ability to evolve the static and dynamic friction.
- Ability to analyse Mechanical vibrations.
- Ability to analyse the properties of solids in relation to moment of Inertia.

UNIT I

Introduction to Mechanics:

Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT II

Friction:

Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions-Motion of Bodies; Wedge & Screw friction, Ladder Friction.

UNIT III

Centroid and Center of Gravity:

Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity of Bodies – Centroids of Volumes – Center of gravity of composite bodies.

Area moments of Inertia:

Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration. Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.

UNIT IV**Mass Moment of Inertia:**

Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration.

Virtual Work: Theory of virtual work-Application.

UNIT V**Kinetics:**

Kinetics of a particle-D'Alemberts principle-Motion in a curved path – work, energy and power. Principle of conservation of energy- Kinetics of rigid body in translation, rotation-work done-Principle of work-energy-Impulse-momentum.

Mechanical Vibrations:

Definitions, Concepts-Simple Harmonic motion- free vibrations- Simple and compound pendulums.

Text Books:

1. Engineering Mechanics: R.K.Bansal, Laxmi publications.
2. Engineering Mechanics: S.S.Bavakatti, New age International.

Reference Books:

1. A Text of Engineering Mechanics /YVD Rao/ K. Govinda Rajulu/ M. Manzoor Hussain Academic Publishing Company.
2. Engineering Mechanics, Statics and Dynamics – S.Rajasekharan & G.Sankara Subramanian Vikas publications.
3. Singer's Engineering Mechanics Statics and Dynamics/ K. Vijaya Kumar Reddy, J. Suresh Kumar/ BSP.
4. Engineering Mechanics/ Irving Shames, G. Krishna Mohan Rao / Prentice Hall.
5. Engineering Mechanics / Bhattacharyya/ Oxford.
6. Foundations and applications of Engineering Mechanics by HD Ram and AK Chouhan, Cambridge publications.
7. Engineering Mechanics: R.C.Hibbeler.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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Department of MECHANICAL ENGINEERING

Engineering Graphics

SEMESTER-I

Subject code: A31ES6

L/T/P C

2/0/4/ 4

Course objectives:

- To provide basic concepts in engineering drawing.
- To impart knowledge about standard principles of orthographic projection of objects.
- To draw sectional views and pictorial views of solids.

Course Outcomes:

- Preparing working drawings to communicate the ideas and information.
- Read, understand and interpret engineering drawings.

UNIT I

Introduction to Engineering Drawing:

Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid Involute. Scales – Plain, Diagonal.

UNIT II

Orthographic Projections:

Principles of Orthographic Projections – Conventions – Projections of Points and Lines Projections of Plane regular geometric figures such as Triangle, Square, Rectangle, Pentagon, Hexagon, Cone and Cylinder.

Auxiliary views:

Auxiliary views of above and Traces.

UNIT III

Projections of Regular Solids

Projection of Regular Solids such as Tetrahedron, Cube, Octahedron, Prisms and Pyramids. Solids of Base as Triangle, Square, Pentagon, Hexagon, Cone and Cylinder.

Auxiliary Views:

Auxiliary views of above.

UNIT IV

Sections or Sectional views of Right Regular Solids:

Cylinder, Cone, Square, Prism and Pyramid, Rectangular Prism and Pyramid, Hexagonal Prism and Pyramid, Pentagonal Prism and Pyramid.

Auxiliary views:

Sections of Sphere.

Development of Surfaces of Right Regular Solids:

Cylinder, Cone, Square Prism and Pyramid.

UNIT V

Isometric Projections:

Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions Auto CAD: Basic principles only.

Text books:

1. Engineering Drawing / Basant Agrawal and Mc Agrawal/ Mc Graw Hill.
2. Engineering Drawing: Gopala Krishna, Subhas Stores.

Reference books:

1. Engineering Drawing / N.S. Parthasarathy and Vela Murali/ Oxford.
2. Engineering Drawing N.D. Bhatt / Charotar.
3. Engineering Drawing/ M.B. Shah, B.C. Rane / Pearson.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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Department of MECHANICAL ENGINEERING

Engineering Physics Lab

SEMESTER-I

Subject code: A31BS7

L/T/P C

0/0/3/ 2

(Any TEN experiments compulsory)

- 1) Dispersive power of the material of a prism – Spectrometer.
- 2) Determination of wavelengths of white source – Diffraction grating.
- 3) Newton's Rings – Radius of curvature of Plano convex lens.
- 4) Melde's experiment – Transverse and longitudinal modes.
- 5) Charging, discharging and time constant of an R-C circuit.
- 6) L-C-R circuit – Resonance & Q-factor.
- 7) Magnetic field along the axis of current carrying coil – Stewart and Gees method and to verify Biot – Savart's law.
- 8) Study the characteristics of LED and LASER diode.
- 9) Bending losses of fibres & Evaluation of numerical aperture of a given fibre.
- 10) Energy gap of a material of p-n junction.
- 11) Torsional pendulum – Rigidity modulus.
- 12) Wavelength of light, resolving power and dispersive power of a diffraction grating using laser.
- 13) V-I characteristics of a solar cell.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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Department of MECHANICAL ENGINEERING

COMPUTER PROGRAMMING IN C LAB

SEMESTER-I

Subject code: A31ES8

L/T/P C

0/0/3/ 2

Course Objectives:

- To write programs in C using structured programming approach to solve the problems.

Course Outcomes:

1. Ability to design and test programs to solve mathematical and scientific problems.
2. Ability to write structured programs using control structures and functions.

Recommended Systems/Software Requirements:

- Intel based desktop PC.
- GNU C Compiler.

1. a) Write a C program to find the factorial of a positive integer.
b) Write a C program to find the roots of a quadratic equation.
2. a) Write a C program to determine if the given number is a prime number or not.
b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
3. a) Write a C program to construct a pyramid of numbers.
b) Write a C program to calculate the following:
$$\text{Sum: } \text{Sum} = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} - \frac{x^{10}}{10!}$$
4. a) The least common multiple (LCM) of two positive integers a and b is the smallest integer that is evenly divisible by both a and b. Write a C program that reads two integers and calls LCM (a, b) function that takes two integer arguments and returns their LCM. The LCM (a, b) function should calculate the least common multiple by calling the gcd (a, b) function and using the following relation:

$$\text{LCM (a,b) = ab / gcd (a,b)}$$

- b) Write a C program that reads two integers n and r to compute the nCr value using the following relation:
- $${}^n C_r = \frac{n!}{r!(n-r)!} .$$
- Use a function for computing the factorial value of an integer.
5. a) Write C program that reads two integers x and n and calls a recursive function to compute x^n .
 - b) Write a C program that uses a recursive function to solve the Towers of Hanoi problem.
 - c) Write a C program that reads two integers and calls a recursive function to compute nCr value.
6. a) Write a C program to generate all the prime numbers between 1 and n , where n is a value supplied by the user using Sieve of Eratosthenes algorithm.
 - b) Write a C program that uses non recursive function to search for a Key value in a given list of integers. Use linear search method.
7. a) Write a menu-driven C program that allows a user to enter n numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.
 - b) Write a C program that uses non recursive function to search for a Key value in a given sorted list of integers. Use binary search method.
8. a) Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.
 - b) Write a C program that reads two matrices and uses functions to perform the following:
 - i) Addition of two matrices.
 - ii) Multiplication of two matrices.
9. a) Write a C program that uses functions to perform the following operations:
 - i) To insert a sub-string into a given main string from a given position.
 - ii) To delete n characters from a given position in a given string.
 - b) Write a C program that uses a non-recursive function to determine if the given string is a palindrome or not.
10. a) Write a C program to replace a substring with another in a given line of text.
 - b) Write a C program that reads 15 names each of up to 30 characters, stores them in an array, and uses an array of pointers to display them in ascending (ie. alphabetical) order.

- 11. a)** 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
- b)** Write a C program to convert a positive integer to a roman numeral. Ex. 11 is converted to XI.
- 12. a)** Write a C program to display the contents of a file to standard output device.
- b)** Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
- 13. a)** Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command-line arguments.
- b)** Write a C program to compare two files, printing the first line where they differ.
- 14. a)** Write a C program to change the nth character (byte) in a text file. Use fseek function.
- b)** Write a C program to reverse the first n characters in a file. The file name and n are specified on the command line. Use fseek function.
- 15. a)** Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).
- b)** Define a macro that finds the maximum of two numbers. Write a C program that uses the macro and prints the maximum of two numbers.

Reference Books:

1. Mastering C, K.R. Venugopal and S.R. Prasad, TMH Publishers.
2. Computer Programming in C, V. Rajaraman, PHI.
3. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education. C++: The complete reference, H. Schildt, TMH Publishers.

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Department of MECHANICAL ENGINEERING

APPLIED PHYSICS

SEMESTER-II

Subject code: A32BS1

L/T/P C
3/1/0/ 3

Course Objectives:

1. To understand the elastic behavior of materials.
2. To understand basic principles of acoustics and architecture of buildings.
3. To study production and applications of ultrasonic's.
4. To understand magnetic, dielectric and superconducting properties.

Course Outcomes:

Upon completion of the subject, students will be able to :

1. Realize the importance of elastic behavior of materials.
2. Learn Sabine's formula for reverberation time and apply in architecture of buildings.
3. Learn various methods of producing ultrasonic's and their uses.
4. Learn magnetic, dielectric and superconducting properties of materials and their skills.

UNIT I

Elastic properties:

Stress and strain, Hooke's law, elastic behavior of a material, factors affecting elasticity, three moduli of elasticity, work done for unit volume in deforming a body, relation between three moduli of elasticity, determination of rigidity modulus – torsion pendulum.

UNIT II

Acoustics of buildings and acoustic quieting:

Introduction, basic requirement for the acoustically good halls, reverberation and time of reverberation, transmission of sound and transmission loss, factors affecting the architectural acoustics and their remedy, sound absorbing materials, sabine formulae, absorption coefficients, stadium seating, movie theater, acoustic quieting.

UNIT III

Ultrasonics:

Introduction, production of ultrasonic waves, magnetostriction method, piezo electric method, detection of ultrasonic waves, properties of ultrasonic waves, use of ultrasonics for nondestructive testing, applications of ultrasonics.

UNIT IV

Dielectric Properties:

Electric dipole, dipole moment, dielectric constant, polarizability, electric- susceptibility, displacement vector, electronic, ionic and orientation polarizations and calculation of their polarizabilities, internal field, Clausius-Mossotti relation, Piezoelectricity, pyroelectricity and ferroelectricity-BaTiO₃ structure.

UNIT V

Magnetic Properties:

Permeability, field intensity, magnetic field induction, magnetization, magnetic susceptibility, origin of magnetic moment, Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment, hysteresis curve based on domain theory, soft and hard magnetic materials, properties of anti-ferro and ferri magnetic materials.

Superconductivity:

Superconductivity phenomenon, Meissner effect, Magnetic field effect, BCS theory, type-I and type-II super conductors and applications of superconductivity.

Text Books:

1. Solid State Physics, A. J. Dekkar, MacMillan publishers.
2. Fundamentals of Physics, Alan Giambattista, BM Richardson and Robert C Richardson, Tata McGraw hill Publishers.
3. Fundamentals of Acoustics, Kinster and Frey, John Wiley and Sons.

Reference Books:

1. Solid state physics, Charles Kittel, Wiley student edition.
2. University Physics, Francis W. Sears, Hugh D. Young, Marle Zeemansky and Roger A Fredman, Pearson Education.
3. Introduction to Magnetic Materials, B.D. Cullity, C.D.Graham, A John Wiley & Sons, Inc., Publication.
4. Elastic and Inelastic Stress Analysis, Irving H. Shames, Francis A. Cozzarelli, Taylor, & Francis Group.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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Department of MECHANICAL ENGINEERING

ENGINEERING CHEMISTRY

SEMESTER-II

Subject code: A32BS2

L/T/P C
4/1/0/ 4

Course Objectives:

1. To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
2. To include the importance of water in industrial usage, significance of corrosion control to protect the structures, polymers and their controlled usage.
3. To acquire knowledge of engineering materials and about fuels and batteries.
4. To acquire required knowledge about engineering materials like cement, refractories and composites.

Course Outcomes:

1. Students will gain the basic knowledge of electrochemical procedures related to corrosion and its control.
2. They can understand the basic properties of water and its usage in domestic and industrial purposes.
3. They learn the use of fundamental principles to make predictions about the general properties of materials.
4. They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

UNIT I

Water and its treatment

Introduction - hardness of water - causes of hardness - types of hardness: temporary and permanent - expression and units of hardness - Estimation of hardness of water by complexometric method. Numerical problems. Potable water and its specifications- Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and Ozonization. Defluoridation - Nalgonda technique - Determination of F⁻ ion by ion- selective electrode method.

Boiler troubles

Sludges, scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning - Softening of water by ion-exchange processes, Lime-Soda process. Desalination of water - Reverse osmosis. Numerical problems - Sewage water - Steps involved in treatment of sewage.

UNIT II

Electrochemistry and Batteries

Electrochemistry:

Electrode - electrode potential, standard electrode potential, types of electrodes – Construction and functioning of Standard hydrogen electrode, calomel and glass electrode. Nernst equation - electrochemical series and its applications. Electrochemical cells: Daniel cell - cell notation, cell reaction and cell emf - Concept of concentration cells - Electrolyte concentration cell - Numerical problems.

Batteries:

Cell and battery - Primary battery (dry cell, alkaline cell and Lithium cell) and Secondary battery (lead acid, Ni-Cd and lithium ion cell),

Fuel cells:

Hydrogen –oxygen and methanol-oxygen fuel cells – Applications.

UNIT III

Polymers:

Definition - Classification of polymers with examples - Types of polymerization - addition (free radical addition) and condensation polymerization with examples.

Plastics:

Definition and characteristics- thermoplastic and thermosetting plastics, compounding and fabrication of plastics (compression and injection moulding). Preparation, Properties and engineering applications of PVC and Bakelite.

Fibers:

Characteristics of fibers - preparation, properties and applications of Nylon-6, 6 and Dacron. Fiber reinforced plastics (FRP) - Applications.

Rubbers:

Natural rubber and its vulcanization - compounding of rubber.

Elastomers:

Characteristics - preparation - properties and applications of Buna-S, Butyl and Thiokol rubber.

Conducting polymers:

Characteristics and Classification with examples - mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

Biodegradable polymers:

Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

UNIT IV

Fuels and Combustion

Classification- solid fuels: coal - analysis of coal - proximate and ultimate analysis and their significance. Liquid fuels - petroleum and its refining, cracking - types - moving bed catalytic cracking. Knocking - octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels - composition and uses of natural gas, LPG, CNG and Biogas.

Combustion:

Definition, Calorific value of fuel - HCV, LCV; Calculation of air quantity required for combustion of a fuel.

UNIT V

Engineering Materials

Cement:

Portland cement, its composition, setting and hardening of Portland cement.

Special cements:

White cement, water proof cement, High alumina cement and Acid resistant cement.

Refractories:

Classification, characteristics of good refractories, Refractoriness, refractoriness under load, porosity and chemical inertness – applications of refractories.

Lubricants:

Classification of lubricants with examples-characteristics of a good lubricants - mechanism of lubrication (thick film, thin film and extreme pressure) - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

Composites:

Introduction - Constituents of composites - advantages, classification and constituents of composites. Applications of composites.

Text Books:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, New Delhi (2010).
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, New Delhi. (2016).

Reference Books:

1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015).
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011).
3. Engineering Chemistry by Thirumala Chary and Laxminarayana, Scitech Publishers, Chennai (2016).

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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Department of MECHANICAL ENGINEERING

MATHEMATICS III

SEMESTER-II

Subject code: A32BS3

L/T/P C

4/1/0/ 4

Course Objectives:

This subject aims to

1. Random Variables that describe randomness of an uncertainty in certain realistic situation and Binomial, Geometric and Normal Distributions.
2. Sampling Distribution of means, variance, point estimation and interval Estimation.
3. The testing of Hypothesis.
4. The topics those deals with methods to find roots of an equation and to fit a desired curve by the method of least squares for the given data.
5. Solving Ordinary Differential Equations using Numerical Techniques.

Course Outcomes:

Upon completion of the subject, students will be able to;

1. Differentiate among many random variables involved in the probability models. It is quite useful for all branches of engineering.
2. To calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations.
3. Find the root of a given equation and solution of a system of equations.
4. Fit a curve for a given data.
5. Finding Integral values using Numerical Techniques.

UNIT I

Random Variable and Distributions:

Introduction, Random Variable, Discrete Random Variable, Continuous Random Variable, probability Distribution function, probability density function, Expectation, Discrete distributions: Binomial and Geometric Distributions, Continuous Distribution: Normal Distribution

UNIT II

Introduction, Population and samples, Sampling Distribution of means(σ -Known), central limit theorem - t-distribution, sampling distribution of means (σ - unknown), sampling distribution of variances - Chi square and F-distributions, point estimation, maximum error of estimate, interval estimation

UNIT III

Tests of Hypothesis:

Introduction, Hypothesis, Null and Alternative Hypothesis, Type-I and Type-II errors, Level of Significance, One tailed and two-tailed tests, Tests of concerning one mean and proportion, two means proportions and their differences.

UNIT IV

Algebraic and Transcendental equations and Curve fitting:

Introduction, Bisection method, Method of false position, Iteration Methods: Fixed point Iteration and Newton Raphson Methods. Solving linear system of equations by Gauss Jacobi and Gauss Seidal Method.

Curve fitting:

Fitting a linear, second degree, exponential, power curve by method of least squares

UNIT V

Interpolation & Numerical Integration:

Introduction, Finite differences, Newton's interpolation formulae, Gauss central difference formulae, Lagrange's interpolation.

Numerical Integration: Newton - Cotes Quadrature formula, Trapezoidal rule - Simpson's 1/3rd and 3/8th rule.

Text Books:

1. Probability and Statistics for Engineers by Richard Arnold Johnson, Irwin Miller and John E Freund, New Delhi Prentice Hall.
2. Probability and Statistics for Engineers and Sciences by Jay L Devore, Cengage Learning
3. Numerical Methods for Scientific and Engineering Computation by M K Jain, S R K Iyengar and R K Jain, New age International Publishers

Reference Books:

1. Fundamentals of Mathematical Statistics by S C Gupta and V K Kapoor, S Chand
2. Introductory Methods of Numerical Analysis by S S Sastri, P H I Learning Pvt Ltd
Mathematics for Engineers and Scientists by Alan Jeffrey, 6th edition, C R C Press.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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Department of MECHANICAL ENGINEERING

PROFESSIONAL COMMUNICATION IN ENGLISH

SEMESTER-II

Subject code: A32HS4

L/T/P C
3/0/0/ 3

Course Objectives:

- Improve the language proficiency of students in English with an emphasis on vocabulary, Grammar, reading and writing skills.
- Equip students to study academic subjects more effectively using the theoretical and
- Practical components of English Syllabus.
- Develop study skills and communications skills in formal and informal situations.
- Improve the language proficiency through audio visual instruction.

Course Outcomes:

The student will be able to;

- Use English language effectively in spoken and written forms.
- Comprehend the given texts and respond appropriately.
- Communicate confidently in formal and informal contexts.
- Able to develop the significance of silent reading and reading aloud focusing on pronunciation sense of reading.

Unit I

Chapter entitled '*Presidential Address*' by *Dr. A.P.J. Kalam* from "*Fluency in English– A Course book for Engineering Students*" published by Orient BlackSwan, Hyderabad.

Vocabulary: Word Formation – Root Words –The Use of Prefixes and Suffixes– Collocations– Exercises for Practice.

Grammar: Punctuation – Parts of Speech- Articles –Exercises for Practice.

Reading: *Double Angels* by David Scott-Reading and Its Importance- Techniques for Effective Reading- Signal Words- Exercises for Practice

Writing: Writing Sentences- Techniques for Effective Writing–Paragraph Writing- Types, Structure and Features of a Paragraph-Coherence and Cohesiveness: Logical, Lexical and Grammatical Devices – Exercises for Practice

Unit II

Chapter entitled *Satya Nadella: Email to Employees on his First Day as CEO* from “*Fluency in English– A Course book for Engineering Students*” Published by Orient BlackSwan, Hyderabad.

Vocabulary: Synonyms and Antonyms – Homonyms, Homophones, Homographs- Exercises for Practice (Chapter 17 ‘*Technical Communication- Principles and Practice*’. *Third Edition* published by Oxford University Press may also be followed.)

Grammar: Verbs-Transitive, Intransitive and Non-finite Verbs – Mood and Tense - Gerund – Words with Appropriate Prepositions – Phrasal Verbs – Exercises for Practice

Reading: Sub-skills of Reading- Skimming, Scanning, Extensive Reading and Intensive Reading – *The Road Not Taken* by **Robert Frost** – Exercises for Practice

Writing: Letter Writing –Format, Styles, Parts, Language to be used in Formal Letters- Letter of Apology – Letter of Complaint-Letter of Inquiry with Reply – Letter of Requisition – Exercises for Practice

Unit III

From the book entitled ‘**Technical Communication- Principles and Practice**’ **Third Edition** published by Oxford University Press.

Vocabulary: Introduction- A Brief History of Words – Using the Dictionary and Thesaurus– Changing Words from One Form to Another – Confusables (From Chapter 17 entitled ‘*Grammar and Vocabulary Development*’)

Grammar: Tenses: Present Tense- Past Tense- Future Tense- Active Voice – Passive Voice- Conditional Sentences – Adjective and Degrees of Comparison. (From Chapter 17 entitled ‘*Grammar and Vocabulary Development*’)

Reading: Improving Comprehension Skills – Techniques for Good Comprehension Skimming and Scanning- Non-verbal Signals – Structure of the Text – Structure of Paragraphs – Punctuation – Author’s viewpoint (Inference) – Reader Anticipation: Determining the Meaning of Words – Summarizing- Typical Reading Comprehension Questions. (From Chapter 10 entitled ‘*Reading Comprehension*’)

Writing: Introduction- Letter Writing-Writing the Cover Letter- Cover Letters Accompanying Resumes- Emails. (From Chapter 15 entitled ‘*Formal Letters, Memos, and Email*’)

Unit IV

Chapter entitled ‘*Good Manners*’ by **J.C. Hill** from *Fluency in English – A Course book for Engineering Students*” published by Orient Blackswan, Hyderabad.

Vocabulary: Idiomatic Expressions –One- word Substitutes --- Exercises for Practice (Chapter 17 ‘*Technical Communication- Principles and Practice*’. *Third Edition*

published by Oxford University Press may also be followed.) **Grammar:** Sequence of Tenses- Concord (Subject in Agreement with the Verb) – Exercises for Practice.

Reading: ‘*If*’ poem by **Rudyard Kipling**–Tips for Writing a Review --- Author’s Viewpoint – Reader’s Anticipation–Herein the Students will be required to Read and Submit a Review of a Book (Literary or Non-literary) of their choice – Exercises for Practice.

Writing: Information Transfer-Bar Charts-Flow Charts-Tree Diagrams etc., -- Exercises for Practice. Introduction – Steps to Effective Precis Writing – Guidelines-Samples (Chapter 12 entitled ‘*The Art of Condensation*’ from ***Technical Communication-Principles and Practice. Third Edition*** published by Oxford University Press)

UNIT V

Chapter entitled ‘**Father Dear Father**’ by **Raj Kinger** from ***Fluency in English – A Course book for Engineering Students***” Published by Orient BlackSwan, Hyderabad

Vocabulary: Foreign Words—Words borrowed from other Languages- Exercises for Practice

Grammar: Direct and Indirect Speech- Question Tags- Exercises for Practice

Reading: Predicting the Content- Understanding the Gist – SQ3R Reading Technique- Study Skills – Note Making – Understanding Discourse Coherence – Sequencing Sentences. (From Chapter 10 entitled ‘**Reading Comprehension**’ – ***Technical Communication- Principles and Practice. Third Edition*** published by Oxford University Press.)

Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports –Formats- Prewriting – Structure of Reports (Manuscript Format) – Types of Reports – Writing the Report. (From Chapter 13 entitled ‘**Technical Reports**’ – ***Technical Communication- Principles and Practice. Third Edition*** published by Oxford University Press.)

Textbooks : Fluency in English – A Text book Referred by the University

Reference Books: A Course in English Communication, Madhavi Apte
Effective Communication Skills, Dr. Ashraf Rizwi
Technical Communication by Meenakshi Raman
Objective English, Edgar Thorpe, Showick Thorpe
English Grammar, Raymond Murphy, Cambridge University Press

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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Department of MECHANICAL ENGINEERING

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

SEMESTER-II

Subject code: A32ES5

L/T/P C

3/0/0/ 3

Course Objectives:

To learn

- To introduce the concept of electrical circuits and its components.
- To introduce the concepts of various semiconductor devices like diodes, transistors, FET's and MOSFET'S.
- To impart the knowledge of various configurations, characteristics and applications of electric and electronic circuits.

Course Outcomes:

After this course, the student will be able

- To analyze and solve electrical circuits using network laws and theorems.
- To identify and characterize the various semiconductor devices and different types of transistors.
- To design different biasing circuits of different semiconductor devices

UNIT I

Electrical Circuits:

R-L-C Parameters, Voltage and Current, Independent and Dependent Sources, Source Transformation – V-I relationship for passive elements, Kirchoff's Laws, Network reduction techniques–series, parallel, series-parallel, star-to-delta, delta-to-star transformation, Nodal and mesh analysis.

Single Phase AC Circuits:

R.M.S. and Average values, Form Factor, steady state analysis of series, parallel and series-parallel combinations of R,L and C with sinusoidal excitation, concept of reactance, impedance, susceptance and admittance – phase and phase difference, Concept of power factor, j-notation, complex and polar forms of representation, series resonance and parallel resonance. Locus diagrams.

UNIT II

Network Theorems:

Thevenin's, Norton's, Maximum Power Transfer, Superposition, Reciprocity, Tellegen's, Millman's and Compensation theorems for DC and AC excitations.

UNIT III

P-N Junction Diode:

Introduction to semiconductor physics, formation of p-type and n-type semiconductors, principle and operation of Diode, Current components in a p-n Diode, Band structure of open circuited p-n junction, Diode equation, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances.

Special Purpose Devices:

Breakdown Mechanisms in Semi-Conductor Diodes, Zener diode characteristics, Use of Zener diode as simple regulator, Principle of operation and Characteristics of Tunnel Diode (With help of Energy band diagram) and Varactor Diode, Principle of Operation of SCR.

UNIT IV

Rectifiers and Filters:

P-N junction diode as a rectifier - Half Wave Rectifier, Ripple Factor, Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π - section Filters.

UNIT V

Bipolar Junction Transistor (BJT):

Construction, Principle of Operation, Transistor current components, Transistor as a switch and as an Amplifier, Common Emitter, Common Base and Common Collector configurations and their Characteristics, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Emitter Feedback Bias, Collector to Emitter feedback bias, Voltage divider bias, Bias stability, Stabilization against variations in V_{BE} and β , Bias Compensation using Diodes and Transistors.

Field Effect Transistor (FET):

Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET.

Metal Oxide Semiconductor Field Effect Transistor (MOSFET):

Different types of MOSFET's, Working operation and V-I Characteristics of different types of MOSFET's.

Text Books:

1. Basic electrical engineering –JJ cathey / S A Nasar
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
3. Millman's Electronic Devices and Circuits – J. Millman and C. C. Halkias, Satyabratajit, TMH, 2/e, 1998.

References Books:

1. Basic Electrical and electronics Engineering –M S Sukija TK Nagasarkar Oxford University.
2. Basic Electrical and electronics Engineering-D P Kothari. I J Nagarath Mc Graw Hill Education.
3. Engineering circuit analysis- by William Hayt and Jack E. Kemmerly, McGraw Hill Company, 6th edition.
4. Linear circuit analysis (time domain phasor and Laplace transform approaches) - 2nd edition by Raymond A. DeCarlo and Pen-Min-Lin, Oxford University Press- 2004.
5. Network Theory by N. C. Jagan& C. Lakshminarayana, B.S. Publications.
6. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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Department of MECHANICAL ENGINEERING

ENGINEERING CHEMISTRY LAB

SEMESTER-II

Subject code: A32BS6

L/T/P C

0/0/3/ 2

LIST OF EXPERIMENTS

Volumetric Analysis:

1. Estimation of Ferrous ion by Dichrometry.
2. Estimation of hardness of water by Complexometric method using EDTA.
3. Estimation of Ferrous and Ferric ions in a given mixture by Dichrometry.
4. Estimation Ferrous ion by Permanganometry.
5. Estimation of copper by Iodomery.
6. Estimation of percentage of purity of MnO₂ in pyrolusite
7. Determination of percentage of available chlorine in bleaching powder.
8. Determination of salt concentration by ion- exchange resin.

Instrumental methods of Analysis:

1. Estimation of HCl by Conductometry.
2. Estimation of Ferrous ion by Potentiometry.
3. Determination of Ferrous iron in cement by Colorimetric method.
4. Determination of viscosity of oil by Redwood / Oswald's Viscometer.
5. Estimation of manganese in KMnO₄ by Colorimetric method.
6. Estimation of HCl and Acetic acid in a given mixture by Conductometry.
7. Estimation of HCl by Potentiometry.

Preparation of Polymers:

1. Preparation of Bakelite and urea formaldehyde resin.

Note: All the above experiments must be performed.

Text Books:

1. Vogel's Text Book of Quantitative Chemical Analysis, 5th Edition (2015).
2. G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney.
3. A Text Book on experiments and calculations in Engineering Chemistry by S.S. Dara
S. Chand & Company Ltd., Delhi (2003).

T K R COLLEGE OF ENGINEERING & TECHNOLOGY
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Department of MECHANICAL ENGINEERING

ENGLISH COMMUNICATION SKILLS LAB

SEMESTER-II

Subject code: A32HS7

L/T/P C
0/0/3/ 2

Course Objectives:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning.
- To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm.
- To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking.
- To improve the fluency of students in spoken English and neutralize their mother tongue influence.
- To train students to use language appropriately for public speaking, group discussions and interviews.

Course Outcomes:

1. Better understanding nuances of English language through audio-visual experience and group activities.
2. Neutralization of accent for intelligibility.
3. Speaking skills with clarity and confidence which in turn enhances their employability skills.
4. Able to communicate in formal and informal situations.

Exercise I

CALL Lab:

Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening.

Practice: Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs- Consonant Clusters- Past Tense Marker and Plural Marker.

Testing Exercises

ICS Lab:

Understand: Spoken vs. Written language- Formal and Informal English.

Practice: Ice-Breaking Activity and JAM Session- Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Exercise II

CALL Lab:

Understand: Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Sentence Stress – Intonation.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Sentence Stress – Intonation.

Testing Exercises

ICS Lab:

Understand: Features of Good Conversation – Strategies for Effective Communication.

Practice: Situational Dialogues – Role-Play- Expressions in Various Situations, Making Requests and Seeking Permissions- pick “n” speak, effective vocabulary building and Telephone Etiquette.

Exercise III

CALL Lab:

Understand: Errors in Pronunciation-the Influence of Mother Tongue (MTI).

Practice: Common Indian Variants in Pronunciation – Differences between British and American Pronunciation.

Testing Exercises

ICS Lab:

Understand: Descriptions- Picture Description-Story Narrations- Giving Directions and Guidelines.

Practice: Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions. Describing people, places and things.

Exercise IV

CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests.

Testing Exercises

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks – Non-verbal Communication- Presentation Skills.

Practice: Making a short speech-Extempore- Making a Presentation.

Exercise V

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests.

Testing Exercises

ICS Lab:

Understand: Group Discussion- Interview Skills.

Practice: Participation in Group Discussion and Mock Interviews.

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

System Requirement (Hardware component):

- *Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:*
- Computers with Suitable Configuration.
- High Fidelity Headphones.

2. Interactive Communication Skills (ICS) Lab:

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio and video system and camcorder etc.

Lab Manuals:

- 1) A book entitled “*ELCS Lab Manual – A Workbook for CALL and ICS Lab Activities*” by Board of Editors: Hyderabad: Orient BlackSwan Pvt. Ltd. 2016. Print.
- 2) Hart, Steve; Nair, Aravind R.; Bhambhani, Veena. “*EMBARK- English for undergraduates*” Delhi: Cambridge University Press. 2016. Print.

Suggested Software:

- 1) Cambridge Advanced Learners’ English Dictionary with CD.
- 2) Grammar Made Easy by Darling Kindersley.
- 3) Punctuation Made Easy by Darling Kindersley.
- 4) Oxford Advanced Learner’s Compass, 8th Edition.
- 5) English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- 6) English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- 7) TOEFL and GRE (KAPLAN, AARCO and BARRONS, USA, Cracking GRE by CLIFFS).

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Department of MECHANICAL ENGINEERING

ENGINEERING WORKSHOP

SEMESTER-II

Subject code: A32ES8

L/T/P C

0/0/3/ 2

Course Objectives:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipment and machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

Course Outcomes:

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

- Study and practice on machine tools and their operations
- Practice on manufacturing of components using workshop trades including house wiring, welding, plumbing, fitting, carpentry and foundry.
- Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
- Apply basic electrical engineering knowledge for house wiring practice.

1. TRADES FOR EXERCISES

- Carpentry.
- Fitting.
- Tin-Smithy and Development of jobs carried out and soldering.
- Black Smithy.
- House-wiring.
- Foundry.
- Welding.
- Power tools in construction, wood working, electrical engineering and mechanical Engineering.

2. TRADES FOR DEMONSTRATION & EXPOSURE

- Plumbing.
- Machine Shop.
- Metal Cutting (Water Plasm).

Text Books:

1. Workshop Practice /B. L. Juneja / Cengage.
2. Workshop Manual / K. Venugopal / Anuradha.

Reference Books:

1. Work shop Manual - P. Kannaiah/ K. L. Narayana/ Scitech.
2. Workshop Manual / Venkat Reddy/ BSP.