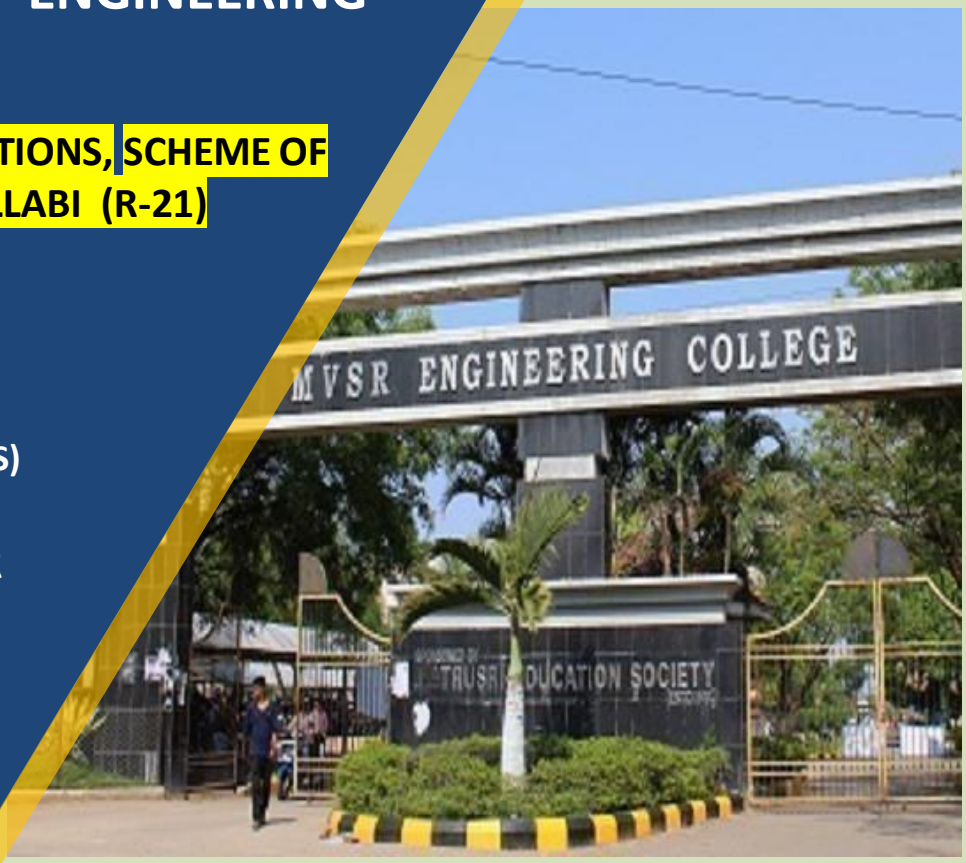
MATURI VENKATA SUBBA RAO ENGINEERING COLLEGE
(An Autonomous Institution)

BACHELOR OF ENGINEERING

ACADEMIC REGULATIONS, SCHEME OF INSTRUCTION & SYLLABI (R-21)

AUTOMOBILE ENGINEERING
(I,II,III & IV SEMESTERS)

ACADEMIC YEAR
2022 - 23



(Sponsored by Matrusri Education Society, Estd.1980)

ACADEMIC RULES AND REGULATIONS
for
Four Years
BACHELOR OF ENGINEERING
DEGREE PROGRAMMES

Maturi Venkata Subba Rao (MVSR) Engineering College

(An Autonomous Institution)

(Sponsored by Matrusri Education Society, Estd.1980)

Approved by AICTE, Affiliated to Osmania University
Accredited by NAAC and ISO 9001:2015 Certified Inst.
NBA Accreditation: CIVIL, CSE, ECE, EEE, IT and MECH.

website: www.mvsrec.edu.in

Counseling Code: TSEAMCET/TSECET/TSICET: MVSR

PGECET: MVSR1

(*For the batch admitted in 2022-23 *(R-21))

B.E. PROGRAMMES
(Full-time)

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of
ACADEMIC RULES & REGULATIONS

ACADEMIC RULES AND REGULATIONS

For Four Year Degree Programme in Engineering

of

Maturi Venkata Subba Rao (MVSR) Engineering College

(For the batch admitted in 2022-23 *(R-21))*

PREAMBLE: All the Rules and Regulations, hereinafter specified shall be read as a whole for the purpose of interpretation. Any reference to college in these Rules and Regulations stands for Maturi Venkata Subba Rao (MVSR) Engineering College. In case of arising a doubt, the interpretation of the Academic Council, the Statutory Body constituted as per UGC regulations of the college is final. The Academic council has the powers to make amendments to these regulations whenever necessary and shall be approved by Governing Body (GB).

ABBREVIATIONS:

AC	Academic Council
AICTE	All India Council for Technical Education
BE	Bachelor of Engineering
BoS	Board of Studies
GB	Governing Body
C	Credits
CGPA	Cumulative Grade Point Average
CIE	Continuous Internal Evaluation
CP	Credit Point
D	Drawing
GO	Government Order
GP	Grade Point
L	Lecture
MOOC	Massive Open Online Course
MVSREC	Maturi Venkata Subba Rao Engineering College
NPTEL	National Programme on Technology Enhanced Learning
P	Practical
SEE	Semester End Examination
SGPA	Semester Grade Point Average
SWAYAM	Study Webs of Active Learning for Young and Aspiring Minds
T	Tutorial
UG	Under Graduate
UGC	University Grants Commission

NOMENCLATURE:

S. No.	Keywords	Definition
1	**Governing Body**	Highest administrative body of the Institute. GB is an authority as per the AICTE/ UGC regulations and responsible to perform functions as may be necessary and deemed fit for the proper development of the institution.
2	**Academic Council**	Highest academic body of the Institute and is responsible for the maintenance of standards of instruction, education and examination within the Institute. Academic Council is an authority as per the AICTE / UGC regulations and has the right to take decisions on all academic matters including academic research.
3	**Academic Year**	A period that is necessary to complete courses of study. It consists of two consecutive (one odd + one even) semesters.
4	**Autonomous Institute**	An Institute designated as 'Autonomous' by University Grants Commission (UGC), New Delhi in concurrence with the affiliating University i.e., Osmania University, Hyderabad and Telangana State Government.
5	**Board of Studies**	An authority, as defined in UGC regulations, constituted by the Principal for each of the department separately. The board is responsible for curriculum design and update in respect of all the programmes offered by a department.
6	**Course**	Usually referred to, as „papers" is a component of a programme. All courses need not carry the same weightage. The learning objectives and learning outcomes are defined for each course. A course is designed to comprise lectures/ tutorials/ laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/ assignments/ presentations/self-study etc. or a combination of some of these.
7	**Course Evaluation**	Continuous Internal Evaluation (CIE) in the Semester & Semester End Examination (SEE) constitutes the main assessment prescribed for each course.
8	**Continuous Internal Evaluation (CIE)**	To be normally conducted by the course instructor which includes class tests, problem solving exercises, group discussions, assignments, quizzes, mini-projects & seminars conducted anytime throughout the semester.
9	**Credit**	A unit by which the course work is measured. One credit is equivalent to one lecture hour of teaching (lecture or tutorial) or two hours of practical / field work per week.
10	**Grade Point**	It is a numerical weight allotted to each letter grade on a 10-point scale. A+ =10, A = 9, B = 8, C = 7, D = 6, E = 5 and F = 0.
11	**Credit Point**	A product of grade point and number of credits for a course.

12	**Cumulative Grade Point Average (CGPA)**	It is a measure of overall cumulative performance, of a student in all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters of the program. It is expressed upto two decimal places.
13	**Programme**	A programme or specialization of a degree programme like Civil Engineering, Mechanical Engineering etc.
14	**Curriculum**	Curriculum incorporates all the courses that are offered in a specific programme. It also indicates the planned interaction of students with instructional content, materials and resources.
15	**Degree**	A student who fulfills all the programme requirements is eligible to receive a degree.
16	**Grading**	To be normally done using Letter Grades as qualitative measure of achievement in each Course like: A+ (Outstanding), A (Excellent), B (Very Good), C (Good), D (Average), E (Pass), F (Fail) based on the marks (%) scored in (CIE+SEE) of the course and conversion to grade done byrelative/absolute grading.
17	**Mandatory Courses**	Compulsory non-credit courses that a student need to study as prescribed in the programme.
18	**Massive Open Online Courses (MOOC)**	Open access online courses aimed at providing ways to learn new skills.
19	**Revision of Regulations, Curriculum and Syllabi**	The institution, from time to time may revise, amend or change the regulations, scheme of examinations, curriculum and syllabi with the approval of the academic council.
20	**Semester End Examination (SEE)**	To be normally conducted at the institutional level which will cover the entire course syllabi. The SEE questions are to be set from each unit. The questions are to be based on Blooms Taxonomy
21	**Semester**	Each year of study is divided into two semesters. Semester shall consist of 16 weeks of academic work excluding Semester End Examination and Evaluation.
22	**Semester Grade Point Average (SGPA)**	It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various theory and lab courses offered in each semester and the total course credits taken during that semester. It shall be expressed upto two decimal places.

I. ADMISSION PROCEDURE

1. A candidate for admission to the Four Year Degree Programme in Engineering must have passed the Intermediate Examination of the Board of Intermediate Education, Government of Telangana with Mathematics, Physics and Chemistry as optional courses, or any other examination recognized bythe Government of Telangana as equivalent thereto.

2. A candidate will be admitted strictly in accordance with the guidelines issued by State Government of Telangana from time to time.

II. DURATION AND PROGRAMMES OF STUDY

The duration of the programme is eight semesters (four years) such as I, II, III, IV, V, VI, VII and VIII. Each academic year shall comprise of two semesters.

Instruction per semester	---	16 weeks
Preparation holidays (includes practical exams)	---	02 weeks

No admission/ readmission/ promotion are entertained after four weeks of the commencement of instruction of semester in I, II, III and IV years.

In case there are any court cases consequent to which the authorities are compelled to admit any candidate after the announced last date of admissions, the admission (seat) of such a student would be reserved for the subsequent year on a supernumerary basis.

No refund of Tuition fee will be made after the commencement of instruction for students who wish to cancel their admission.

1. The following programmes of study are offered by the college.

S. No	Programme
i).	Automobile Engineering
ii).	Civil Engineering
iii).	Computer Science and Engineering
iv).	Electrical and Electronics Engineering
v).	Electronics and Communication Engineering
vi).	Information Technology
vii).	Mechanical Engineering

The schedule of study of all programmes is regulated by the Academic council of Maturi Venkata Subba Rao (MVSR) Engineering College.

2. Candidate who fails to fulfill all the requirements for the award of the degree as specified here in after within (N+2) academic years from the time of admission, *as per the UGC Guidelines on determination of uniform span period (UGC Letter No. F-12-1/2015 (CPP-II) dated and 15.10.2015 and Osmania University letter No.336/M/Acad.I/2016 dated 21.03.2016)*, will forfeit his/her seat in the programme and his/her admission will stand cancelled, where „N" is the number of years of programme of study. For four year regular B.E. degreeprogrammemaximumdurationofstudyis (N+ 2) = 4 + 2 = 6 years.

   Candidate admitted to the second year under lateral entry scheme shall fulfill all the requirements for the award of the degree as specified here in after within (N+2=3+2=5) five academic years from the time of admission failing which he/she will forfeit his/her seat and his/her admission will stand cancelled.

III. RULES AND REGULATIONS OF ATTENDANCE

1. Candidates admitted to a particular programme of study are required to pursue **Regular programme of study** before they are permitted to appear for the Semester End Examination.

2. **A regular programme of study** means putting in attendance of not less than 75% in each semester.

3. In special cases and for sufficient cause shown, the Academic Council (AC) may condone the deficiency in attendance to the extent of 10% on medical grounds subject to the submission of medical certificate (signed by Competent Authority) along with the payment of condonation fee too.. However, in respect of women candidates who seek condonation of attendance due to pregnancy, the Academic Council (AC) on the specific recommendations may condone the deficiency in attendance to the extent of 15% (as against 10% condonation for others) on medical grounds(Valid Medical certificate) subject to submission of medical certificate to this effect. Such condonation is permitted only once during the programme of study.
   Medical certificate along with the fitness is to be submitted within a week days on reporting to the class work.
   * **Shortage of attendance below 65 % shall in no case be condoned.**

4. The fee for condonation of attendance on medical grounds shall be Rs. 2000/- (Rupees Two Thousand only) payable through DD/ Banker Cheque drawn in favour of Principal, Maturi Venkata Subba Rao (MVSR) Engineering College.

5. Attendance of N.C.C / N.S.S Camps or Inter collegiate or Inter-University or Inter State or International matches or debates or Educational Excursions or such other Inter University activities as approved by the authorities involving journeys outside the city in which the college is situated will not be counted as absence.

   (i) Such absence shall not exceed four weeks per semester of the total period of instructions.

   (ii) Such leave should be availed with prior permission from the Principal and not be availed more than twice during the programme of study.

   (iii) Without anyprior permission, such leave shall be treated as absence.

   (iv) While calculating the attendance, the number of classes not attended in each subject shall be added to the numerator.

6. The attendance shall be calculated on the aggregate of courses from the date of commencement of classes/ date of readmission in case of detained candidates as per the almanac.

7. In case of candidates who fail to put in the required attendance in a programme of study, he/she shall be detained in the same semester and will not be permitted to appear for the Semester End Examination. Such candidates shall have to seek readmission into the same semester during the subsequent year in order to appear for the examination after fulfilling the attendance requirements and on payment of requisite tuition fee.

IV. SCHEME OF INSTRUCTIONS AND EXAMINATION

1. Instructions in various courses in each semester of all four years shall be provided by the college as per the scheme of instruction and syllabi prescribed. All students have to register for the courses offered in the Semester before starting of that particular semester.

2. The total number of credits for all eight semesters is 160 as per AICTE Model Curriculum

3. The distribution of marks/grade* based on Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE) shall be as follows:

Subject	Continuous Internal Evaluation (CIE)	Semester End Examination (SEE)
Each theory subject	**30 ****	**70 ******
Each practical or drawing Subject for which less than 6 periods / week are provided in the scheme of instruction	**25 ****	**50**
Each practical or drawing Subject for which 6 or more Periods/week are provided in the scheme of instruction	**50 *****	**100**
Project I	**50 #**	**---**
Project II	**50 #**	**100 ##**

Total marks = CIE + SEE

***** Grades are allotted based on the marks secured in CIE and SEE as per the following criteria.

Academic Performance	Grade		Grade points
	Letter	Description	
90% ≤ Marks ≤ 100%	**A +**	Outstanding	10
80% ≤ Marks < 90%	**A**	Excellent	9
70% ≤ Marks < 80%	**B**	Very Good	8
60% ≤ Marks < 70%	**C**	Good	7
50% ≤ Marks < 60%	**D**	Average	6
40% ≤ Marks < 50%	**E**	Pass	5
0% ≤ Marks < 40%	**F**	Fail	0
	AB	Absent	

** Out of 30 CIE marks for theory, 10 marks are allotted for Assignments/Tutorials/Quizzes etc. (At least two assignments and two quizzes are to be conducted) in the course. The rest of the 20 marks are allotted to internal tests. Two internal tests will be conducted in each semester. Each test will carry 20 marks, out of which 6 marks for PART-A (compulsory), consisting of three short answer questions and from Part- B two questions consisting of subjective questions are to be attempted from the remaining three questions and each question carries 7 marks. Average of two tests plus marks obtained in assignments/tutorials/quizzes etc. will be taken as CIE marks.

*** Out of 25/50 CIE marks for Practical/drawing, 10/ 20 are allotted for viva- voce exam / Quiz test, 15/30 marks for laboratory record/drawing sheets and observations.

**** The SEE question paper consists of seven questions and each question carries 14 marks. The first question is compulsory and covers the entire syllabus as part A. Student has to answer four questions from the remaining six questions that cover the entire syllabus as part B.

The CIE evaluation of BE Project (Project - I & II) consists of a maximum of 50 marks which will be distributed as per the guidelines given below:

(i) **30 Marks** are allocated for qualityof the project work covering
- (a) Literature review
- (b) Innovation/ Originality
- (c) Methodology and
- (d) Relevance / Practical application which will be awarded by the supervisor.

(ii) **20 Marks** are allocated to candidate"s performance in terms of viva-voce examination and overall subject knowledge. Marks will be awarded by the committee constituted by the HoD.

The evaluation of BE Project (Project II) for Semester End Examination consists of a maximum of 100 marks which will be distributed as per the guidelines given below:

(i) **50 Marks** are allocated for quality of the project work covering
- (a) Literature review
- (b) Innovation / Originality
- (c) Methodology and
- (d) Relevance/ Practical application, which will be awarded jointly by the internal and external examiners.

(ii) **50 Marks** are provided for candidate"s presentation and performance in terms of viva-voce examination and overall subject knowledge. Out of 50 Marks 30 marks will be awarded by the internal examiner and 20 marks by the external examiner concerned.

Note:

(i) A course that has CIE but no SEE as per scheme is treated as Pass/ Fail for which pass marks are 40% of CIE marks.

(ii) Mandatory courses shall not carry any credits but, securing **40% of total marks**, shall be **necessary requirement** for the student to qualify for the **award of Degree.**

1. The details of instruction period, examination schedule, vacation etc. shall be notified by the Principal, Maturi Venkata Subba Rao Engineering College.

2. The medium of instruction and examination shall be English.

3. At the end of each semester, SEE shall be held as prescribed in the respective Schemes of Examination. The examinations pertaining to the semester just ended, will be called, regular examinations and the examinations pertaining to the other semesters will be called supplementary examinations. To enable the B.E. Final Year students to complete the program requirements in time, there shall be a Make-up / Supplementary Exam for VIII semester only, which will be scheduled within one month of publication of results of VIII semester regular examinations.

4. The examinations prescribed may be conducted by means of written papers, practical and viva-voce, inspection of certified CIE work in Drawing and Laboratories and Workshop, or by means of any combination of these methods as may be deemed necessary. Candidates will be required to produce complete Lab Records of the Practical work done by them in each practical examination, along with other materials prepared or collected as part of Laboratory work / Project.

5. All the general rules for examinations (given under item no. X) shall be adhered to.

6. A candidate shall be deemed to have fully passed a course, if he/she secures

   - A minimum of 40% marks for each theory course in the Semester End Examination (SEE)
   - A minimum of 40% marks (E – Grade) for each theory course considering both CIE and SEE.
   - A minimum of 50% marks for each Practical/ Drawing/ Project work in the Semester End Examination (SEE)
   - A minimum of 50% marks (D – Grade) for each Practical/ Drawing/ Project work considering both CIE and SEE.

   Important note: The candidate has to mandatorily appear at the SEE in all the Practical/Laboratory/Drawing Courses irrespective of marks secured under CIE.

7. In case of hearing impaired, orthopedically handicapped and visually challenged candidates, 10% reduction in pass marks in each subject is admissible as per G.O. Ms. No.150, dated 31-08-2006.

8. If a candidate desires to have his/her answer scripts revaluated, he/she can apply for it as per the college norms and notification of the College Examination Branch.

9. A candidate can also obtain a photocopy of the corrected answer book of the theory courses of SEE only against payment. For more details in this regard, the press note of the College Examination Branch after the declaration of results may be referred.

V. RULES OF PROMOTION

S. No.	Semester / Class	Conditions to be fulfilled	
1.	From I-Semester to II-Semester	Regular programme of studyof B.E. I-Semester	
2.	From II-Semester to III-Semester	a)	Regular programme of study of B.E. II-Semester
		b)	Must have earned at least 50% of credits (rounded to the next nearest integer) prescribed for B.E. I-Semester and II-Semester.
3.	From III-Semester to IV-Semester	Regular programme of studyof B.E. III-Semester	
4.	From IV-Semester to V-Semester	a)	Regular programme of study of B.E. IV-Semester

		b)	No. of backlog credits, if any of B.E. I, II, III and IV Semester put together shall not exceed 50% (rounded to the next nearest integer) of the total number of credits prescribed for the B.E. III & IV-Semester
5.	From V-Semester to VI-Semester	Regular programme of study of B.E. V-Semester	
6.	From VI- Semester to VII-Semester	a)	Regular programme of study of B.E. VI-Semester
		b)	Number of backlogs, if any of B.E. I, II,III, IV, V and VI Semester put together shall not exceed 50% (rounded to the next nearest integer) of the total number of credits prescribed for the B.E. V & VI-Semester
7.	From VII-Semester to VIII-Semester	Regular programme of studyof B.E. VII-Semester	

Note: 1. If a candidate has more than permitted number of credits as backlogs, he/she will be detained.

2. The candidate who wishes to take readmission into the year in which he/she is detained will have to pay the total tuition fee of that year and all the credits earned during that year shall become null and void.

VI. GRADING SYSTEM

1. Candidates who have passed all the examinations of the B.E. Degree Programme shall be awarded Cumulative Grade Point Average (CGPA) in accordance with the grade secured by them in all eight Semesters taken together, including the CIE marks secured in those semesters.
   The grade secured shall be shown in the memorandum of marks as per the performance in CIE and SEE.
   A minimum CGPA of 5 is required for the award of Degree. The consolidated memorandum of marks will reflect the credits/ grade scored in each course.

1. Semester Grade Point Average (SGPA) & Cumulative Grade Point Average (CGPA)

Calculation:

a) $$\text{SGPA} = \frac{\sum_{i=1}^{p} (\text{Letter Grade Point}_i \times \text{Credits}_i)}{\sum_{i=1}^{p} \text{Credits}_i}$$

Where i = 1, 2, …..p represent the number of courses in a particular semester. SGPA is calculated upto second decimal point and it is calculated only when all courses in that semester are Cleared/ Passed.

b) $$\text{CGPA} = \frac{\sum_{j=1}^{m} [(\text{SGPA})_j \times (\text{Total Credits})_j]}{\sum_{j=1}^{m} \text{Total Credits}_j}$$

where j = 1, 2, ….m represent the number of semesters of the entire programme.

CGPA at a given point of Semester is calculated upto second decimal point. It is calculated only when total credits earned are equal to total credits prescribed as per scheme upto a semester in which the candidate has last appeared for SEE.

c) Courses in which the candidate has failed are not included in computing SGPA/ CGPA.

VII. AWARD OF DEGREE

The degree of bachelor of engineering will be conferred on candidate who has pursued a regular programme of study of four academic years (three academic years for candidates admitted in II-Year under lateral entry scheme), as hereinafter prescribed in the scheme of instruction and has passed all the examinations as prescribed in the scheme of examinations.

Note: For **mandatory and audit courses (non-credit),** student shall be awarded a Grade without anycredit. This shall not be counted for the computation of SGPA/CGPA.

VIII. AWARD OF GOLD MEDAL

(i) A student securing highest CGPA in **single attempt** is eligible for award of Gold Medal.

(ii) A readmitted student is not eligible for Gold medal.

IX. IMPROVEMENT OF OVERALL SCORE

1. A candidate who wishes to improve his/her overall score may do so within one academic year immediately after having passed all the examinations of the B.E. degree programme, by reappearing in not more than two semesters (all courses pertaining to the semester taken together) examinations without violating the rule mentioned in the item II.3.

2. For the award of the overall score, he/she will have the benefit of the higher SGPA secured in the corresponding semester(s).

X. GENERAL RULES OF EXAMINATIONS

1. Application for permission to appear in any examination shall be made available online through college website (www.mvsrec.edu.in) as per the notification.

2. When a candidate"s application is found in order and he/she is eligible to appear in Semester End Examination (SEE), the College Examination Branch shall furnish him with a Hall-Ticket, enabling the candidate to appear in the Semester End Examination. The Hall-Ticket shall have to be produced by the Candidate before he/she is admitted to the premises where the Examination is likelyto be held.

3. A candidate who does not present himself/herself for examination for any reason whatsoever, excepting shortage of attendance, shall not be entitled to claim refund of the whole or part of the examination fee, for subsequent Examination(s).

4. A candidate after he/she has been declared successful in the all examinations, shall be given a provisional certificate stating the year of examination, the branch in which he/she was examined and, the overall grade secured. However, the candidates have to obtain degree certificate (convocation) from the Examination Branch, Osmania University, Hyderabad.

5. No candidate shall be allowed to put in attendance for a programme or appear at examinations for different degrees and different faculties simultaneously.

6. Students who have appeared once in any examination of the programme need not put in fresh attendance, if they wish to reappear at the corresponding examination, notwithstanding the fact that the college may have introduced new courses. They will, however, have to appear at the examinations according to the scheme of examination any syllabi in force.

XI. TRANSITORY REGULATIONS

1. Whenever a course or scheme of instruction is changed in a particular semester/year, two more examinations immediately following thereafter shall be conducted according to the old syllabus/regulations, provided the content in the course has changed more than 40%.

2. Candidates not appearing at the examinations or failing in them shall take the examination subsequently according to the changed syllabus/regulations.

XII. RANGE OF CREDITS

1. A regular student will be eligible to get an Under Graduate degree in Engineering if he/she secures the credits as specified in the Scheme of Instruction and Examinations.
   A lateral entry student shall be declared eligible to get an Under Graduate degree in Engineering if he/she
   a) Secures required credits as specified in the Scheme of Instruction and Examinations from Semester - III to Semester - VIII
   b) Qualifies bridge courses and mandatory courses specified if any during Semester - I and Semester – II

XIII. MALPRACTICE AND AWARD OF PUNISHMENT

Schedule on the Nature of Malpractice and Award of Punishment

"Examination" in this context refers to all the papers taken by the candidate on the same hall-ticket.

MALPRACTICE AND AWARD OF PUNISHMENT

S. No	Malpractice	Award of Maximum Punishment
1	Possession of the prohibited (written or printed) papers, books, notes during the examination period but which were not used.	Only that exam shall be cancelled. No reference either to the previous or future exams.
2	Matter relevant to the examination being written on any part of the body or on the clothes worn, or in the instrument, wrapping, etc.	-do-
3	Attempting to take help from any prohibited papers, notes, written or printed matter, writings on the walls, furniture and attempting to take help from or giving help to other regarding answer to any question or questions of the examination paper.	-do-
4	Taking help from or consulting of prohibited written or printed material; consulting and/or taking help from or helping other examinee during the examination period inside the examination hall or outside it; with or without their consent, or helping other	-do-

	candidate to receive help from any other.	
5	An examinee who attempts to disclose his/her identity to the paper valuer by writing his/her roll number at a place other than the place prescribed for it, or by writing his/her name or any coded message or an examinee who makes an appeal to the paper valuer in the answer book.	-do-
6	Writing such as invocation of God"s name in any form.	To be ignored
7	Writing on the question paper or other papers; the answer to questions, rough work, etc., with no intention of passing it on to another examinee.	To be warned not to do so.
8	Using abusive and obscene language in the answer book.	To warn and assess on the basis of content.
9	Examinee allowing or destroying prohibited material found in his possession or acting in any other manner with a view to destroy evidence.	Only that exam shall be cancelled. No reference either to the previous or future exams.
10	Refusing to obey instructions of the Chief Superintendent/Invigilator.	Only that exam shall be cancelled. No reference either to the previous or future exams.
11	Smuggling an answer book/ additional answer book/ matter into or out of the examination hall.	Only that exam shall be cancelled. No reference either to the previous or future exams.
12	Inserting in or removing from the answer book/additional answer book of any sheet.	-do-
13	Substituting wholly or partly an answer book/additional answer book.	-do-
14	Impersonation even at a single examination.	To be dealt with as per Law.
15	Cases of examinees when conspiring to interchange in Roll Nos.	Only that exam shall be cancelled. No reference either to the previous or future exams.
16	Creation of disturbance or otherwise misbehaving in and around the examination hall during or before the examination.	Only that exam shall be cancelled. No reference either to the previous or future exams.
17	Guilty of assaulting/abusing intimidating any person connected with the examination work any time before, during or after the examination.	Only that exam shall be cancelled. No reference either to the previous or future exams.
18	Punishments for malpractices not defined here would be recommended on the merits of the individual cases by the malpractices committee.	

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Maturi Venkata Subba Rao (MVSR) Engineering College (Autonomous)
Department of Automobile Engineering

Scheme of Instructions for B.E. (Automobile Engineering) for 8 Semesters

S. No	Course Work – Subject Area	Credits/ Semester								Credits Obtained/ Required
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences (HS)	**3**	**-**	**6**	**-**	**2**	**-**	**-**	**-**	**11/12**
2	Basic Sciences (BS)	**9**	**9**	**3**	**-**	**3**	**-**	**-**	**-**	**24/25**
3	Engineering Sciences (ES)	**8**	**7**	**4**	**-**	**-**	**-**	**-**	**-**	**19/24**
4	Professional Subjects –Core (PC)	**-**	**-**	**8**	**20**	**15**	**13**	**6**	**3**	**65/48**
5	Professional Subject-Electives (PE)	**-**	**-**	**-**	**-**	**3**	**6**	**6**	**3**	**18/18**
6	Open Subjects – Electives (OE)	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**9/18**
7	Project Work, Seminar and/or Internships (PW)	**-**	**-**	**-**	**-**	**1**	**-**	**5**	**8**	**14/15**
8	Mandatory Courses (MC) (Non-Credit)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	TOTAL	**20**	**16**	**21**	**20**	**24**	**22**	**20**	**17**	**160/160**
	Contact Hours/ Week	**25**	**24**	**24**	**24**	**26**	**24**	**21**	**27**	

B.E. (Automobile Engineering) I – SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hr.)	
Theory Courses										
1	U21HSN01EG	English	2	-	-	2	30	70	3	2
2	U21BSN01MT	Engineering Mathematics - I	3	1	-	4	30	70	3	4
3	U21BSN02CH	Applied Chemistry	3	-	-	3	30	70	3	3
4	U21ESN01CS	Programming for problem solving using C	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
5	U21HSN81EG	English Lab	-	-	2	2	25	50	3	1
6	U21BSN81CH	Chemistry Lab	-	-	4	4	25	50	3	2
7	U21ESN81CE	Computer aided Engineering Drawing	1	-	4	5	50	50	3	3
8	U21ESN81CS	Programming for problem solving using C Lab	-	-	4	4	25	50	3	2
Total			**12**	**1**	**14**	**27**	**245**	**480**	**-**	**20**

* **3 Weeks** induction program will be organized before commencement of the coursework of Semester – I

BS: Basic Science,
ES: Engineering Science
HS: Humanities and Social Sciences

L: Lecture
T: Tutorial
P: Practical
D: Drawing

CIE: Continuous Internal Evaluation
SEE: Semester End Evaluation

Note:

1. Each contact hour is a clock hour
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
U21HSN01EG	**English**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**2**

Course Objectives

The objectives of this course is to enhance the English language abilities of students by

- Using authentic material for language learning
- Developing appreciation to a variety of content-rich texts
- Strengthening their grammar and vocabulary
- Improving reading and comprehension skills and also encouraging them to think critically and creatively
- Honing their writing skills

Course Outcomes

After completing this course, the student will be able to:

- Demonstrate the skill of reading to summarize, paraphrase and give an accurate account of authentic texts of various genres
- Infer and make predictions based on the comprehension of a text
- Employ Academic Vocabulary appropriately with a distinction of its formal and informal use
- Apply different reading strategies to comprehend different texts and decode new words encountered
- Undertake guided and extended writing using accurate grammatical structures and vocabulary

Unit-I

Reading : A.G. Gardener – "On Saying Please"
Vocabulary : Word formation-Prefixes, Suffixes, Root Words
Grammar : Articles, Prepositions, Determiners
Writing : Guided Writing (Expanding the outline/Writing from verbal cues)

Unit –II

Reading : Fritz Karinthy – "Refund "
Vocabulary : Word formation- Compounding and Blending, Contractions
Grammar : Transitions, Connectives
Writing : Paragraph-writing

Unit- III

Reading : Narayan Murthy – "Value System"
Vocabulary : Synonyms, Antonyms, One Word Substitutes
Grammar : Voice
Writing : Letter-writing

Unit- IV

Reading : Robert Frost – "Stopping by Woods on a Snowy Evening"
Vocabulary : Homophones, Homonyms, Homographs
Grammar : Narration (Direct-Indirect Speech)
Writing : Precis writing

Unit- V

Reading	:	Stephen Leacock – "On the Need for a Quiet College"
Vocabulary	:	Inclusive Language, Euphemisms
Grammar	:	Tenses
Writing	:	Paraphrasing and Summarizing

Text Books:

1. Board of Editors. Language and Life: A Skills Approach. Orient BlackSwan, 2018.
2. Sudharshana, NP and C Savitha, English For Engineers. Cambridge University Press, 2018.
3. Kumar, Sanjay and Pushp Lata, English Language and Communication Skills for Engineers. Oxford University Press,

Course Code	Course Title						Core/Elective
U21BSN01MT	**Engineering Mathematics - I**						**Core**
Prerequisite	Contact Hour s per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

The objectives of this course is to

- Introduce the concepts of sequences, series and their properties
- Introduce the concepts of mean value theorems and curvature
- Introduce the concepts of multiple integrals
- Study vector differential and vector integral calculus

Course Outcomes

After completing this course, the student will be able to:

- Determine the convergence of infinite series using various tests of convergence
- Solve problems based on the fundamental theorem of differential calculus, find radius of curvature, evaluate and envelopes and expand functions using Taylor & MacLaurin series
- Evaluate Double and Triple integrals in Engineering Problems
- Solve problems based on vector differentiation.
- Solve problems based on vector integration

UNIT-I:

Infinite Series: Introduction to sequences, Infinite series, general properties of infinite series, geometric series, series of positive terms, Harmonic series(p-series),Comparison test, D' Alembert's ratio test, Raabe's test, Cauchy's nth root test, Alternating series, absolute and conditional convergence

UNIT-II:

Differential Calculus: Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem(without proofs) and their applications, Taylor and Maclaurin series, Curvature, Radius of curvature(Cartesian form),Centre of Curvature, Evolute and Involute, Envelope of a family of curves

UNIT-III:

Multiple Integrals: Introduction to functions of two and three variables, Double integrals, Change of order of integration, Change of variables from Cartesian to Plane Polar coordinates, Triple integrals(Cartesian)

UNIT-IV:

Vector Differentiation: Scalar and vector point functions, Vector operator del, Gradient, Unit normal vector, Directional derivative, Angle between surfaces, Divergence, solenoidal vector, Curl, Irrotational vector, Laplace operator applied to scalar and vector point functions.

UNIT-V:

Vector Integration: Line integral-work done, Surface integral, Volume integral, Green's theorem in a plane, Stoke's theorem, Gauss divergence theorem(without proofs) and their verifications.

Text Books:

1. R. K. Jain &S. R .K. Iyengar, *Advanced Engineering Mathematics*, Narosa Publications, 5th Edition 2016.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publications, 44th Edition, 2018.

Reference Books:

1. B.V. Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.
2. N. Bali, M. Goyal, *AtextbookofEngineeringMathematics*, Laxmi publications, 2010
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 9th Edition, 2012.
4. B. Thomas Jr. and Ross L. Finney *Calculus and Analytic Geometry*.
5. M. Tom. Aposta, l *Calculus: One -Variable Calculus with An Introduction to Linear Algebra*, Vol 1

Course Code	Course Title						Core/Elective
U21BSN02CH	**Applied Chemistry**						**Core**
Prerequisite	Contact Hour s per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to

- To relate how the basic concepts and principles of chemistry can be applied to practical utility in a broader perspective of the society.
- To distinguish the ranges of electromagnetic spectrum and its interaction with matter and to develop knowledge of various spectroscopic techniques at atomic and molecular levels.
- To identify and apply various principles of electrochemistry and corrosion which are essential for an engineer in industry
- To bring adaptability to the concepts of chemistry and to acquire the required skills to become a perfect engineerTo provide an overview of ordinary differential equations and their applications.

Course Outcomes

After completing this course, the student will be able to:

- Apply the knowledge of electrode potentials in finding feasibility of electrochemical reactions, construction of electrochemical cells, understanding the mechanism of corrosion, factors affecting metallic corrosion and corrosion control by various methods.
- Summarize the knowledge in thermodynamic principles and their applications.
- Appraise the basic concepts of engineering materials such as polymers, composites, and lubricants.
- Classify various energy sources and illustrate the importance and applications of renewable and non-renewable energy sources.
- Estimate the physical and chemical parameters of quality of water and explain the process of water treatment
- Relate the concepts of Phase rule and green chemistry to modify engineering processes and materials.Solve problems based on vector differentiation.

UNIT-I:

Electro Chemistry & Corrosion and It's control: Electro Chemistry: Electrochemical Cells-Electrolytic and galvanic cells-notation. Cell Reaction and Cell EMF. Electrode potential, Standard electrode potential. Electrochemical series and Applications. Free Energy and EMF. Nernst equation and its derivation, Applications -Numerical problems. Types of electrodes-Standard hydrogen electrode, Calomel electrode Silver-Silver Chloride, Quinhydrone and glass electrodes. Determination of pH using Quinhydrone electrode coupled with saturated Calomel electrode.

Corrosion: Definition, Causes and effects. Types of corrosion, Chemical corrosion, and its mechanism. Electrochemical corrosion and its mechanism. Galvanic corrosion, Concentration cell Corrosion-Waterline and Pitting corrosion. Factors effecting rate of corrosion. Corrosion control methods- Cathodic Protection –Sacrificial anode and impressed current cathode methods. Surface Coatings-Types. Electro plating and Electroless plating of metal coatings.

UNIT-II:

Thermodynamics: Definition of terms: System, Surroundings. Types of thermodynamic systems and processes. Reversible and irreversible processes. Extensive and Intensive properties. The concept of Internal energy, Enthalpy. Work done in isothermal and adiabatic reversible and irreversible processes- Numericals. **First law of thermodynamics and its limitations.**

Second law of thermodynamics- statements. Spontaneous and non-spontaneous processes. Concept of Cyclic processes. The Carnot cycle and efficiency of reversible heat engine. Carnot's theorem. Concept of entropy -Entropy changes in reversible and irreversible processes. Physical significance of entropy. Gibbs-Helmotz free energy and its significance. Variation of free energy with T, P. Criteria for spontaneity /feasibility of process. Numerical problems.

UNIT-III:

Engineering Materials: Polymers: Basic terminology - Monomer and its functionality, Polymers, and degree of polymerization. Types of Polymerizations - Chain Growth, Step Growth Polymerization – Examples.Plastics, Fibers, Elastomers – Characteristics and Examples.Preparation, Properties & Applications – PVC, Bakelite, Nylon 6:6, Kevlar, Buna-S, Butyl Rubber, and Silicone Rubber.**Composite materials:** Introduction of composites, constituents of composites. Advantages of composites. Classification of composites based on matrix, reinforcement, and ply. Applications of composites.**Lubricants**: Definition, classification with examples. Function of lubricants, Types of lubrication and mechanism – Thick Film or Hydrodynamic Lubrication, Thin Film or Boundary Lubrication, Extreme Pressure Lubrication. Properties of lubricants – Viscosity, flash and fire point, cloud and pour point, acid value. Saponication number.

UNIT-IV:

Energy Sources: Introduction-Renewable and non-renewable energy sources with Examples. Chemical fuels: Definition, Classification of chemical fuels-primary, Secondary and Solid, Liquid, Gaseous fuels -examples. Solid fuels: Coal & its composition, and its ranking. Liquid fuels: Petroleum- Fractional distillation of petroleum. Cracking and its significance. Knocking, Octane Number and Cetane number. Gaseous Fuels: LPG, CNG- composition, properties and uses. Biodiesel: Concept -Transesterification- Carbon neutrality. Advantages of Bio-diesel. Batteries: Definition, Types of batteries-Primary batteries; Zn-Carbon battery. Secondary batteries; Lead-acid, Lithium -ion batteries. Fuel cells: Definition, Construction and working of H2-O2 fuel cells and Methanol- O2 fuel cells. Solar cells: Concepts of photovoltaic cell and its applications.

UNIT-V:

Water Chemistry, Green Chemistry and Phase Rule: Water & its Treatment: Hardness of water – Types- Units of hardness. Estimation of temporary and permanent hardness of water by EDTA method- Numerical problems Alkalinity of water and its determination- Numerical problems. Softening of water by a) Ion exchange process. b) Zeolite Process, c) Desalination of water by Reverse Osmosis. Specifications of potable water. Sterilization by Chlorination. Break-point chlorination.

Green Chemistry: Concept, Principles of green Chemistry with Examples.

Phase rule: Definition of terms: Phase, Component, and degrees of freedom. Phase rule – state ment and equation. Application to one component system-Water system. Condensed phase rule-two component system; Pb-Ag system. Pattinson's process of desilverization of lead. Safety fuses and Solders.

Text Book:

1. P.C. Jain, M. Jain Engineering Chemistry, Dhanapathi Rai and sons (16th edition), New Delhi

Reference Books:

1. Sashi Chawla, Textbook of Engineering Chemistry, Dhanapathi Rai &sons, New Delhi.
2. O.G. Palanna, Engineering Chemistry, TMH Edition.
3. Puri, Sharma and Pathania Principles of physical chemistry, Vishal Publishing Co.
4. Polymer chemistry by Gowariker.
5. Shikha Agarwal, Engineering Chemistry fundamentals and applications, Cambridge University press.

Course Code	Course Title						Core/Elective
U21ESN01CS	**Programming for Problem Solving Using C**						**Core**
Prerequisite	Contact Hour s per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to impart knowledge of

- To introduce the concept of computing environment, number systems, algorithms, flowcharts and implementation using variables with various data types and selection statements.
- To introduce the logic building techniques using control statements and arrays
- To understand modular and structure programming using functions and strings
- To learn the alternative to iteration using recursion and familiarization with structures and macros
- To understand memory management using pointers and dealing with files

Course Outcomes

After completing this course, the student will be able to:

- Formulate simple algorithms/flowcharts there by translating them into programs using variables with various data types and selection statements.
- Implement logic building techniques using control statements and arrays
- Apply modular and structure programming using functions and strings
- Analyze the iteration with recursion and implementation of structures and macros.
- Illustration of memory management techniques using pointers and implement the file handling approach

UNIT-I:

Introduction to computers: Introduction to components of a computer system, Operating system, Number system: Decimal, binary, octal, hexa decimal systems.
Algorithms/Flowcharts: Logical and Numerical problem solving
Introduction to C Programming: Structure of C, Execution phases in C (Compiler, interpreter, Linker, loader), C-tokens, syntax & semantics in compilation, Identifiers, variables, keywords, Data Types, Operators, precedence & associativity rules, Expression evaluation, Type conversion.
Selection statements: simple if, if-else, else-if ladder, nested if-else, switch

UNIT-II:

Iteration statements: while, do-while, for, **Unconditional statements:** break, continue, goto, return
Arrays: 1-D arrays, **Searching Techniques:** Linear, binary search, **Sorting algorithms:** bubble sort and selection sort,2-D arrays: Matrices

UNIT-III:

Strings: Defining & initializing strings, String manipulation functions (predefined, user-defined)
Functions: Taxonomy of functions, built-in functions, parameter passing techniques: call by value, Passing arrays to functions: Idea of call by reference
Storage classes: auto, register, static, extern

UNIT-IV:

Recursive functions: Recursion definition, Iteration vs Recursion, Example programs: GCD, Factorial, sum of digits, fibonacci
Structures: Defining & accessing structured data, Array of structures, passing structure to function, nested structures, Difference between structure & union
Preprocessor directives: Macros, #define, #if, #elif

UNIT-V:

Pointers: Introduction to pointers, Defining pointers, pointer arithmetic, Array of pointers, pointer to array, Null pointer, generic pointer, double pointers, passing pointer to function: call by address, Accessing structure using pointer, self-referential structure, Dynamic memory allocation

File Handling: I/O streams, File operations, file modes, Sequential/Random accessing files, command line arguments.

Text Book:

1. B.A. Forouzan and R.F.Gieverg, "A structured Programming Approach in C" language learning 2013.

Reference Books:

1. Paul Deitel & Harvey Deitel, *"C How to program"* 7th edition,PHI
2. A.K. Sharma,, *"Computer Fundamentals and Programming in C"* - Universities Press,2nd edition,2018
3. E. Balagurusamy, *"Programming in ANSI C"* -, TMH, 2008
4. Byron Gottfried - "*Theory and practice of Programming with C",* Schaum's Outline McGrawHill,1990
5. Pradip Dey, Manas Ghosh, *"Programming in C"*- Oxford University Press, 2nd edition
6. Brian W Kernighan and Dennis M Ritchie, *"The C programming Language",* Prentice Hall of India,1988

Course Code	Course Title						Core/Elective
U21HSN81EG	**English Lab**						**Core**
Prerequisite	Contact Hour s per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**20**	**50**	**1**

Course Objectives

The objectives of this course is to enhance the listening and speaking skills of students by

- Giving them sufficient practice in listening with comprehension.
- Providing them ample opportunities to improve their public speaking skills.
- Training them in the use of correct pronunciation, stress, and intonation.
- Sensitizing them to the use of verbal and non-verbal communication appropriate to the context.
- Encouraging them to learn the art of conversation to suit formal and informal situation.
- Preparing them to make formal presentations and face interviews.

Course Outcomes

After completing this course, the student will be able to:

- Listen, understand, and interpret formal and informal spoken language
- Speak English with acceptable pronunciation, stress, and intonation
- Present themselves with confidence in formal situations
- Be able to perform in fluency, accuracy and time management based activities such as JAM and Picture Perception
- Participate in individual and group activities with relative ease.

List of Activities:

1. Listening for Comprehension
2. Pronunciation, Intonation, Stress, and Rhythm
3. Conversation Skills
4. Introducing Oneself and others
5. Asking for and Giving Information
6. Making Requests and Responding to them Appropriately
7. Giving Instructions and Responding to them Appropriately
8. Making Formal Announcements and Emceeing
9. Picture Perception
10. JAM
11. Role play
12. Group Discussions
13. Interview Skills
14. Presentation Skills

Text Books:

1. Board of Editors. *Language and Life: A Skills Approach*. Orient BlackSwan, 2018.
2. Balasudbramanian, T. *A Textbook of English Phonetics for Indian Students.* Macmillan, 1981
3. CIEFL. *EXERCISES IN Spoken English.* Parts. I- III. Oxford University Press. Pillai,
4. Radhakrsihna G. Spoken *English For You – Level II*. 8the Edition. Emerald Publishers, 2014.
5. Sethi, J and PV Dhamija. *A Course in Phonetics and Spoken English*. 2ndEdition. Prentice Hall India Learning Private Limited, 1999.

Course Code	Course Title						Core/Elective
U21BSN81CH	**Chemistry Lab**						**Core**
Prerequisite	Contact Hour s per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives

During the course the student is expected to

- Introduce practical applications of chemistry concepts to solve engineering problems.
- Measure the molecular or ionic properties such as conductance, redox potentials.
- To determine the rate constant of reactions from concentrations as a function of time.
- Know the laboratory practices implemented in a research and industrial chemistry laboratory setting.
- To learn to Synthesize polymers

Course Outcomes

After completing this course, the student will be able to:

- Estimate the hardness of water sample.
- Apply the principles of Electrochemistry & Colorimetry in quantitative estimations.
- Measure the properties of liquids such as surface tension and Viscosity.
- Estimate the rate constants, of reactions from concentration of reactants/ products as a function of time.
- Synthesize Polymer.

List of experiments:

1. Estimation of Fe (II) by Permanganometry.
2. Estimation of Fe (II) by Dichrometry.
3. Estimation of hardness of water by EDTA method.
4. Estimation of HCl by Potentiometry.
5. Potentiometric estimation of Iron Fe (II) by Permanganometry.
6. Estimation of HCl by Conductometry.
7. Estimation of CH_3COOH by Conductometry.
8. Estimation of HCl & CH_3COOH in mixture by Conductometry.
9. Estimation of HCl by pH metry.
10. Verification of Beer-Lamberts Law and estimation of Manganese in $KMnO_4$by Colorimetry.
11. Determination of viscosity of liquids using Oswald's viscometer
12. Determination of Surface tension by using Stalagmometer.
13. Synthesis of nylon 6,6.
14. Determination of rate constant of acid catalyzed hydrolysis of methyl acetate.
15. Determination of Partition Coefficient of CH_3COOH in n-Butanol and Water.

Text Books:

1. Vogel's text book of Practical organic chemistry, 5thEdition.

Reference Books:

1. B.D. Khosala, A. Gulati and V. Garg, *Senior Practical Physical Chemistry*, (R. Chand & Co.,Delhi)
2. S.S.Dara, *Text book on experiments and Calculations in Engineering Chemistry*
3. K.K. Sharma and D.S. Sharma, *An introduction to practical chemistry* (Vikas Publications, NewDelhi)

4. S.K.Bhasin & Sudha Rani, *Laboratory manual on Engineering Chemistry*, (Dhanpat Rai Publishing Company.

Course Code	Course Title						Core/Elective
U21ESN81CE	**Computer Aided Engineering Drawing**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**1**	**-**	**4**	**-**	**50**	**50**	**3**

Course Objectives

The objectives of this course is to impart knowledge

- To make students communicate effectively through common drawing language in an effective way
- To prepare the students communicate using AUTOCAD with the help of technical knowledge
- To prepare the students in the engineering drafting skills
- To enhance the imaginative skills of students there by making them creative

Course Outcomes

After completing this course, students will be able to:

- Understand the importance of engineering drawing and its place in society
- Expose the virtual aspects of Engineering Drawing
- Recognize modern technical tools of engineering drawing like AUTOCAD and apply in different fields of engineering
- Think creatively in getting alternative options to practical problems in engineering
- Communicate technical aspects through engineering drawing

Sheet No	Description of the Topic	Contact Hours	
		Lecture	Drawing
1	Principles of Engineering Graphics and their significance, usageofdrawing instruments.	1	
2	***Conic Sections – I*** Construction of ellipse, parabola and hyperbola given focus andeccentricity.	1	2
3	***Conic Sections – II*** Construction of ellipse (given major and minor axis), parabola(given base and height), rectangular hyperbola.		2
4	***Cycloids*** (Cycloid, Epicycloids, Hypocycloid)	1	2
5	***Involutes*** (involute of triangle, square & circle)		2
6	***Scales*** (Plain, diagonal & Vernier scales)	1	2 + 2
7	***Introduction to AutoCAD*** Basic commands and simple drawings.		2 + 2
8	***Orthographic Projection*** Projections of points situated in different quadrants.	1	2
9	***Projections of straight lines – I*** Line parallel to both the reference planes, line perpendicular orinclined to one reference plane.	1	2

10	***Projections of straight lines – II*** Line inclined to both the reference planes.	1	2
11	***Projections of planes – I*** Perpendicular planes	1	2
12	***Projections of planes – II*** Oblique planes		2
13	***Projections of solids – I*** Polyhedra and solids of revolution, Projections of solids in simpleposition.	1	2
14	***Projection of solids – II*** Projections of solids when the axes inclined to one or both thereference planes.	1	2 + 2
15	***Section of solids – I*** When the sectional plane is parallel or perpendicular to onereference plane.	1	2
16	***Section of solids – II*** When the sectional plane is inclined to one reference plane.		2
17	***Development of surfaces – I*** Prisms and Cylinders	1	2
18	***Development of surfaces – II*** Pyramids and Cones		2
19	***Intersection of surfaces – I*** Intersection of cylinder and cylinder	1	2
20	***Intersection of surfaces – II*** Intersection of cylinder and cone		2
21	***Isometric projection – I*** planes and simple solids	1	2
22	***Isometric projection – II*** combination of two or three solids		2
23	Conversion of Isometric Views to Orthographic Views	1	2

Text Books:

1. N.D. Bhatt, V. M Panchal & P. R. Ingle , *"Engineering Drawing",* Charotar Publishing House, 2014
2. M. B. Shah, & B. C. Rana , *"Engineering Drawing and Computer Graphics",* Pearson Education, 2008
3. S. N. Lal, *"Engineering Drawing with Introduction to Auto CAD",* Cengage Learning India Pvt Lid, New Delhi, 2018.
4. B. Agrawal & C. M. Agrawal, *"Engineering Graphics",* TMH Publication, 2012
5. K. L. Narayana, & P. Kannaiah, *"Text book on Engineering Drawing",* Scitech Publishers, 2008
6. (Corresponding set of) CAD Software Theory and User Manuals

Note:

1. At least 20 sheets must be drawn.
2. Sheet number 1 to 6 (Graph sheets / drawing sheets)
3. Sheet number 7 to 23 (AutoCAD drawings)

Course Code	Course Title						Core/Elective
U21ESN81CS	**Programming for Problem Solving Using C Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives

The objectives of this course is to impart knowledge of

- Understand the fundamentals of programming in C Language.
- Write, compile and debug programs in C.
- Formulate solutions to problems and implement them in C.
- Effectively choose programming components to solve computing problems
- To apply the sorting and searching techniques on given set of data

Course Outcomes

After completing this course, the student will be able to:

- Choose appropriate data type for implementing programs in C language.
- Design and implement modular programs involving input output operations, decision making and looping constructs.
- Implement search and sort operations on arrays.
- Apply the concept of pointers for implementing programs on dynamic memory management and string handling.
- Design and implement programs to store data in structures and files.

Write C programs for following:

1. Express and compute few mathematical equations in C language

Selection statements:

2. Finding roots of a quadratic equation
3. Implement arithmetic calculator using switch
4. Check whether entered year is a leap year or not

Iteration statements:

5. Find maximum and minimum value in a given set of numbers
6. Print multiplication table of value X upto Y times
7. Print prime numbers between M & N, Check for armstrong number or not
8. Convert a decimal number to binary and vice versa
9. Display pyramid of numbers and pascal triangle upto N rows

Arrays:

10. Find maximum, minimum and sum of all numbers in a 1-D array
11. Implement linear & binary search using 1-D array
12. Implement bubble sort & selection sort using 1-D array
13. Find the sum and product of two matrices using 2-d arrays
14. Check whether a matrix is an identity matrix or not using 2-d arrays
15. **Programs on Strings:** perform string manipulation functions , convert a lowercase string into uppercase
16. Demonstrate on call by value & call by reference using functions
17. **Programs on Recursion:** GCD, sum of digits, fibonacci series, factorial

Structures & Union:

18. Using an array of structures, Store 5 students information (name, roll no, subject1,subject2,subject3,total_marks), compute total_marks of each student and display details of each student.

19. Store 3 employee information (name, salary, designation) and access each employee using union.

Pointers:

20. Demonstrate on pointer arithmetic
21. Find the biggest and smallest of array using pointer to array
22. Implement dynamic memory allocation

Files:

23. Writing/reading/appending some data to a file
24. Copy the contents of one file to other file
25. Count the frequency of characters, lines and words in a given file

Text Books:

1. Paul Deitel & Harvey Deitel "*C How to program"* by 7th edition,PHI
2. A.K. Sharma, *"Computer Fundamentals and Programming in C"*-, Universities Press,2nd edition,2018
3. E. Balagurusamy, *Programming in ANSI C* TMH, 2008
4. Byron Gottfried - *"Theory and practice of Programming with C",* Schaum's Outline McGrawHill,1990
5. Pradip Dey, Manas Ghosh ,*"Programming in C"*-, Oxford University Press, 2nd edition
6. Brian W Kernighan and Dennis M Ritchie, *"The C programming Language"*, Prentice Hall of India,1988

B.E. (Automobile Engineering) II- SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/ week	CIE	SEE	Duration of SEE (Hr.)	
Theory Courses										
1	U21BSN02MT	Engineering Mathematics-II	3	-	-	3	30	70	3	3
2	U21BSN02PH	Applied Physics	3	-	-	3	30	70	3	3
3	U21ES201ME	Applied Mechanics	3	-	-	3	30	70	3	3
4	U21MCN01CE	Environmental Science	2	-	-	2	30	70	3	0
Practical/ Laboratory Courses										
5	U21BSN81PH	Physics Lab	-	-	4	4	25	50	3	2
6	U21BSN81MT	Computational Mathematics lab	-	-	2	2	25	50	3	1
7	U21ESN82CS	Programming for Problem Solving using Python Lab	-	-	4	4	25	50	3	2
8	U21ESN81ME	Workshop Practice	-	-	4	4	50	50	3	2
Total			**11**	**-**	**14**	**25**	**245**	**480**	**-**	**16**

BS: Basic Science,
ES: Engineering Science
HS: Humanities and Social Sciences

L: Lecture
T: Tutorial
P: Practical
D: Drawing

CIE: Continuous Internal Evaluation
SEE: Semester End Evaluation

Note:
1. Each contact hour is a clock hour
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
U21BSN02MT	**Engineering Mathematics - II**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to

- Provide an overview of ordinary differential equations and their applications.
- Study Linear algebra and its uses in solving system of linear equations.
- Study Eigenvalue problems and Quadratic forms.
- Study the special functions Gamma and Beta functions.

Course Outcomes

After completing this course, the student will be able to:

- Solve first order differential equations.
- Solve higher order differential equations.
- Solve system of linear equations.
- Solve eigenvalue problems and Quadratic forms.
- Apply Beta and Gamma Functions to evaluate definite integrals

UNIT-I:

Differential Equations of First Order: Exact differential equations, Integrating factors, Linear differential equations, Bernoulli's and Riccati's. Applications of first order differential equations - Orthogonal trajectories of a given family of curves(Cartesian form) Newton's Law of Cooling, Growth and Decay.

UNIT-II:

Differential Equations of Higher Order: Solutions of second and higher order linear homogeneous equations with constants coefficients, Solutions of non-homogeneous linear differential equations with constants coefficients, Method of reduction of order, Method of variation of parameters Applications of second order differential equations-LCR circuits.

UNIT-III:

Matrices: Rank of a matrix, Elementary Row/Column operations, Echelon form, Normal form, Linear dependence and independence of vectors, System of linear equations, Linear transformation.

UNIT-IV:

Eigenvalues and Eigenvectors: Eigenvalues, Eigenvectors, properties of Eigenvalues, Cayley -Hamilton theorem(without proof), Quadratic forms, Reduction of quadratic form to canonical form, Rank, Index, Signature and Nature of quadratic forms.

UNIT-V:

Special Functions: Gamma function, Beta function, properties of Gamma and Beta functions, relation between Beta and Gamma functions, evaluation of definite integrals using Beta and Gamma functions.

Text Books:

1. R. K. Jain & S .R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition 2016.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44thEdition,2018.

Reference Books:

1. B.V. Ramana, *Higher Engineering Mathematics*, 23rd reprint, 2015.
2. N. Bali, M. Goyal, *A text book of Engineering Mathematics*, Laxmi publications,2010.
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 9th Edition, 2012.

Course Code	Course Title						Core/Elective
U21BSN02PH	**Applied Physics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**		**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to

- To explain the concepts of elasticity.
- To provide knowledge on basics concepts of Solid State Physics.
- To provide the concept of Laser technology, Optical fibers and their applications
- To introduce the concept of Acoustics and Ultrasonics.
- To introduce Nano Science and Nanotechnology .

Course Outcomes

After completing this course, the student will be able to:

- Recall the fundamental principles of elasticity and relate to the advanced level courses.
- Explain Crystal Structures and Crystal Defects
- Explain the principle of Laser and Optical Fiber; Summarize different types of Laser sources and Optical fibers; Identify the applications of Lasers and Optical Fibers
- Describe the fundamental principles of acoustics; summarize the production, detection, properties and applications of Ultrasonics.
- Summarize various types of Nanomaterials, their preparation methods and list out various Characterization Techniques and applications of Nanomaterials..

UNIT-I:

Elasticity: Concepts of Elasticity, Plasticity, Stress , Strain and Hooke's Law, Different Moduli of elasticity- Young's Modulus, Bulk Modulus, Rigidity Modulus and Poisson's Ratio, Relation between Elastic moduli, Torsional Pedulum, Bending of Beam.

UNIT-II:

Crystallography And Crystal Defects: Crystalline and non-crystalline solids, Space lattice, Basis, Unit cell and crystal structure, Crystal systems and Bravais lattices, Simple Cubic, Body Centered and Face Centered Cubic structures, Miller Indices - crystal planes, Interplanar spacing 'd' , Bragg's law, Powder diffraction method.Crystal defects- types of defects in crystals, Point defects- Schottky and Frenkel defects, Concentration of Frenkel defects in ionic crystals, Line defects- Edge and Screw dislocations, Burger's vector.

UNIT-III:

Lasers And Optical Fibers: Introduction to LASERs, Characteristics of Lasers, Spontaneous and Stimulated emissions, Components of LASERs, LASERs operating in UV- Vis-IR Regions, Types of LASERS- Solid State LASER(RUBY LASER), Gas LASER(He-Ne Laser), and Semiconductor LASER, Applications of LASERs.

Introduction to Optical fibre, Basic principle – Total internal reflection, Propagation of light through the fibre - Numerical Aperture and Acceptance angle, Step-Index and Graded- Index optical fibres, Applications of Optical fibres.

UNIT-IV:

Acoustics And Ultrasonics: Classification of Sound Waves- Noise and Music, Weber- Fechner Law, Reverberation, Reverberation Time, Sabine's Formula, Determination of Absorption Coefficient, Factors affecting the Architectural acoustics and their remedies. Introduction to Ultrasonic's, Properties of Ultrasonic waves, Production of Ultrasonic waves by Piezo electric and Magnetostriction methods, Detections of Ultrasonic's, Determination of wavelength of Ultrasonic waves, Applications of Ultrasonic's.

UNIT-V:

Nano Materials And Experimental Techniques: Origin of Nano Science- Bulk and Nano materials, types of nanomaterials, Surface to volume ratio and Quantum confinement effect, properties of nanomaterials, fabrication of nanomaterials- Top-down approach and Bottom-up approach, Ball milling method, and Sol-Gel methods, elementary ideas of Carbon nanotubes (CNT'S)Applications of nanomaterials. Material characterization techniques-X-Ray diffraction, Atomic Force Microscopy- Nanoindentation, SEM and TEM.

Text Books:

1. M.S. Avadhanulu and P.G. Kshirasagar, *A text book Engineering Physic*s, S. Chand and Co., 9th edition, 2010.
2. R.K. Gaur and S.L. Gupta, *Engineering Physics*, Dhanpat Rai publications, 8th edition, 2001.
3. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Learning India(P) Ltd., 2012
4. R. Murugesan and K. Sivaprasath, *Modern Physics*, S. Chand & Company, 13th edition, 2007.
5. A. Goswami, *Thin Film Fundamentals*, New Age International, 2007.
6. A.K. Bandopadhyay, *Nano Materials*, New Age International, 1st edition, 2007.
7. K.J. Pratap. et.al, .*Engineering Physics*
8. M. Armugam, *Engineering Physics*

Course Code	Course Title						Core/Elective
U21ES201ME	**Applied Mechanics**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Physics, Mathematics	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

The objectives of this course is to impart knowledge of

- Resolution of forces, equilibrium and compatibility conditions of static loads.
- Friction, laws of friction and its applications in different fields.
- Centroid, moment of inertia and mass moment of inertia for various regular and composite bodies.
- Kinematics and kinetics of particles and rigid body motions.
- Principle of work- energy method and impulse-momentum method.

Course Outcomes

After completing this course, the student will be able to:

- Analyze the effect of a coplanar and non-coplanar system of force on a body and equilibrium conditions for static loads.
- Determine the effect of friction and its governing laws on simple and connected systems.
- Determine the Centroid, Area Moment of Inertia & Mass moment of Inertia of different areas.
- Analyse kinematics and kinetics of particles and rigid body motions.
- Evaluating unknown variables in a system using principles of work-energy and impulse-momentum methods.

UNIT – I:

Introduction: Introduction to Mechanics: Force and components, resolution of forces, Couple, Moment of force - Vector and Scalar approach, resultant of a coplanar and concurrent forces in planar and space, concept of Free Body Diagrams, Equilibrium, Numericals.

UNIT – II:

Friction: Introduction, theory of friction, laws of friction, Static and Dynamic friction, angle of friction, angle of repose, Cone of friction, friction between connected bodies, Ladder, Wedge, Rolling resistance, Numericals.

UNIT – III:

Geometrical Properties of Surfaces and Solids: Centroid and Center of Gravity: Introduction, Centroid of line, area – composite area, theorems of Pappus and Guldinus, Centre of Gravity of volumes and composite bodies, Numericals.
Area moments of Inertia: Introduction, Parallel axis and Perpendicular axis theorem, Moment of Inertia by integration method, determination of Moment of Inertia for I, T, L, and C sections, Polar Moment of Inertia, Radius of Gyration, Numericals. Mass Moment of Inertia: Introduction, Mass Moment of Inertia, Radius of Gyration, transfer formula for Mass Moment of Inertia – applications – Sphere, Cylinder, Numericals.

UNIT – IV:

Kinematics and Kinetics of Particles and Rigid bodies: Kinematics: Introduction, Motion of particle, rectilinear and rotary motion, Velocity and Acceleration in rectangular coordinates, projectile motion – Types of Rigid body, Angular motion, Numericals. Kinetics: Introduction, fundamental equation of kinetics for a particle, D' Alembert's principle for particle motion, connected system, Numericals.

UNIT – V:

Energy and Momentum Methods: Work - Energy Method: Introduction, Equations for Translation, Work-Energy Applications to Particle Motion, Connected System, Numericals. Impulse Momentum Method: Linear impulse momentum, law of conservation of momentum, coefficient of restitution, Elastic impact, Numericals.

Text Books:

1. L. Ferdinand, Singer, *Engineering Mechanics Statics and Dynamics*, HarperCollins Publishers, Singapore, 3rd edition, 1975
2. S. S. Bhavikatti, K. G. Rajashekarappa, *Engineering Mechanics*, New Age International Pvt. Ltd., New Delhi, 8th edition, 2021
3. A Nelson, *Engineering Mechanics Statics and Dynamics*, Tata McGraw Hill Education, New Delhi, 1st edition, 2009.

References Books:

1. P. N. Chandramouli, *Engineering Mechanics*, PHI, New Delhi, 2011.
2. S. Timoshenk, D.H. Young, *Engineering Mechanics*, McGraw Hill, New York, 5th edition, 2017.
3. J. L. Meriam, L.G. Kraige, *Engineering Mechanics* Volume I - Statics, Volume – II Dynamics, John Wiley &Sons, New Jersey, 7th edition, 2012.

Course Code	Course Title						Core/Elective
U21MCN01CE	**Environmental Science**						**Mandatory**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**0**

Course Objectives

- To create awareness and impart basic knowledge about the environment and its allied problems.
- To know the significance and functions of ecosystem.
- To understand importance of biological diversity.
- To study different forms of pollution and their impact on environment.
- To know social and environment related issues and their preventive measures.

Course Outcomes

After completing this course, students will be able to:

- Develop an attitude of concern towards the environment.
- Understand the importance of ecosystem.
- Conservation of natural resources and biological diversity.
- Develop knowledge on Environmental pollution and Environmental loss
- Adopt environmental ethics to attain sustainable development

UNIT - I

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness. Natural Resources: Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources–World Food Problems, effects ofmodernagriculture,fertilizer-pesticidesproblems,waterlogging,salinity, Forest Resources –Use and over exploitation, deforestation & its effect on tribal people. Land Resources–Land Degradation, soil erosion and desertification. Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources.

UNIT - II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)

UNIT - III

Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity.

UNIT -IV

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, Soil pollution, noise pollution, thermal pollution, solid waste management. Environment Protection Act: Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation.

UNIT -V

Social Issues and the Environment: Watershed management and environmental ethics. climate change, global warming, acid rain, ozone layer depletion. Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Disaster management cycle and disaster management in India.

Text Books:

1. A. K. De, *Environmental Chemistry*, Wiley Eastern Ltd., 2016.
2. E. P. Odum, *Fundamentals of Ecology*, W.B. Sunders Co.,USA, 2017
3. M .N. Rao and A. K. Datta, *Waste Water Treatment*, Oxford and IBK Publications, 2020
4. Benny Joseph, *Environmental Studies*, Tata McGraw Hill, 2005.
5. V. K. Sharma, *Disaster Management*, National Centre for Disaster Management, IIPE, 1999.

Course Code	Course Title						Core/Elective
U21BSN81PH	**Physics Lab**						**Core**
Prerequisite	Contact Hour s per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**4**	**25**	**50**	**2**

Course Objectives

During the course the student is expected to

- To analyze a Semiconducting device and determine its temperature Coefficient of Resistance, Energy Gap, Electrical Conductivity, Mobility, concentration of charge carriers and its efficiency.
- To determine the wavelength of given laser source, Sodium vapour lamp by using diffraction grating.
- To explain the principle of Optical Fiber and determine its Numerical Aperture, Acceptance Angle and losses.
- To demonstrate Torsional Pendulum, LCR Series and Parallel Circuit and calculate Rigidity Modulus of a given wire and frequency of LCR Series and Parallel Circuit.
- To examine the nature of Ferro Magnetic Materials, Dielelctric Materials and Calculate their related parameter
- To explain Seebeck Effect and Determine Seebeck Coefficient of thermoelectric device.

Course Outcomes

After completing this course, the student will be able to:

- Analyze a Semiconducting device and determine its temperature Coefficient of Resistance, Energy Gap, Electrical Conductivity, Mobility, Concentration of charge carriers and efficiency.
- Determine the Wavelength of Laser source, Sodium Vapour lamp using diffraction grating.
- Explain the principle of Optical Fiber and determine its Numerical Aperture, Acceptance angle and losses.
- Demonstrate Torsional Pendulum, LCR series and Parallel circuit and calculate the Rigidity Modulus of given metallic wire, resonant frequency of LCR Series & Parallel circuit.
- Examine the nature of ferromagnetic materials, dielectric materials and calculate their related parameter
- Explain Seebeck Effect and determine Seebeck Coefficient of thermoelectric device

List of experiments:

1. To Determine the Numerical aperture (NA), Acceptance Angle of the Optical Fiber, and To study the various losses of that occur in optical fiber.
2. To determine the wave length (λ) of the given Laser source.
3. To determine V-I characteristics of the given LED.
4. To draw the V-I characteristics of a Solar Cell and calculate the Fill Factor and Series Resistance.
5. To draw the I - V Characteristics of P-N Junction diode and to evaluate the resistance for forward biasand revers bias.
6. To determine the constants of A, B and α using Thermistor characteristics.
7. To find the values of Electrical conductivity and energy gap of Ge crystal.
8. To determine the wave length of radiation emitted by Sodium vapour lamp using Diffraction Grating.
9. To study the behavior of Series LCR Resonant circuit and to estimate the resonant frequency and Q factor.
10. To study the variation in currant and voltage in parallel LCR Circuit and to find the resonant frequency of parallel LCR Circuit.
11. Determination of rigidity of modulus of Torsional pendulum.
12. To determine the Dielectric constant ofthe given Dielectric samples.
13. To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron rod) and to find out i) Coercivity ii) Retentivity and iii) Hysteresis loss.
14. To calculate Seebeck Coefficient of the given sample.
15. To determine the Hall coefficient, Carrier concentration and mobility of charge carriers of semi conducting material.
16. To determine the velocity of the Ultrasonic Waves

Course Code	Course Title						Core/Elective
U21BSN81MT	**Computational Mathematics Lab**						**Core**
Prerequisite	Contact Hour s per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

The objectives of this course is to

- know the history and features of Math tools like SCI LAB/MATLAB
- know the local environment of MATLAB/SCI LAB
- study the concept of definite integrals, differential equations and system of equations using MATLAB/SCI LAB
- study the concept of Eigenvalues and Eigenvectors using MATLAB/SCI LAB.
- study simple mathematical functions using 2D and 3D plots

Course Outcomes

After completing this course, the student will be able to:

- understand the main features of the MATLAB/SCI LAB program development environment to enable their usage in the higher learning
- evaluate definite integrals using MATLAB/SCI LAB.
- solve linear differential equations with constant coefficients using MATLAB/SCI LAB .
- solve system of linear equations using MATLAB/SCI LAB.
- find Eigenvalues and Eigenvectors using MATLAB/SCI LAB
- Interpret and visualize simple mathematical functions using 2D and 3D plots.

List of Programs:

1. Introduction to MATLAB and GUI
2. Basic operators of MATLAB/ SCI LAB
3. Finding roots of algebraic equations.
4. Determinant of matrices.
5. Rank of a matrix
6. Solving system of linear equations using matrices.
7. Eigenvalues.
8. Eigenvectors.
9. Solutions of first order linear differential equations.
10. Solutions of second order linear homogeneous differential equation with constant coefficients.
11. Evaluating definite integrals
12. Data plotting for 2D and 3D

Reference Books:

1. Computational Mathematics Lab Manual

Course Code	Course Title						Core/Elective
U21ESN82CS	**Programming for Problem Solving using Python Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives

The objectives of this course is to impart knowledge of

- To introduce python programming environment
- Enabling students to learn basic fundamentals of python
- To improve logical skills by working with control statements, mathematical functions
- To learn about modular programming through functions and recursive programs
- To handle logical, syntax errors and define custom errors as per real world problems
- Enabling students to access files and perform operations
- To introduce and work with object oriented principles

Course Outcomes

After completing this course, the student will be able to:

- Implement basic syntax, semantics in python and improve logical skills
- Formulate mathematical computations, store data using strings, arrays, collection types
- Perform modular programming using functions and recursion
- Handle and define multiple exceptions logically, syntactically and also able to access files
- Analyze and implements OOP concepts in real world problems

Write python programs for the following:

1. Find distance between two points x1, y1, x2, y2 taking input from the user.
2. Read a set of numbers from the command line, add & print those numbers.
3. Determine checking whether a given year is a leap year or not.
4. Read a date and check whether the date is valid or not, if it is valid print incremented date.
5. Display two random numbers that are to be added, the program should allow the student to enter the answer. if the answer is correct, a message of congratulations should be displayed, if the answer is wrong the correct answer should be displayed.
6. Compute A. $\sum_{i=1}^{n}$ (n+nn+nnn+...) B. $\sum_{i=1}^{n}$ (1/n!) C. $\sum_{i=1}^{n}$ (nn)
7. Read x,y and print all prime numbers between x and y where x<=y
8. Check for “amicable” numbers, armstrong number & strong number
9. Read a number N and Print following patterns up to N rows:

A.
```
1
2 3
4 5 6
7 8 9 10
```

B.
```
    *
  * *
* * *
  * *
    *
```

10. Demonstrate on string operations
11. Matrix programs using numpy: addition, multiplication, identity, transpose
12. Determine the number of vowels and consonants from string using a function that accept string as argument.
13. Recursion programs: factorial, gcd, fibonacci series
14. Demonstrate on List, Set, Tuple, Dictionary
15. Creating a text file and writing some data to the file
16. Open an existing file, Read and display data from the file, display a message if file not found

17. Copy contents of a file to another file
18. Open a file and display the frequency occurrence of characters, lines, words in that file
19. Demonstrate on predefined multiple exceptions
20. Demonstrate on custom exceptions
21. Creating a Class which performs Basic Calculator Operations and invokes each operation using an object.
22. Creating a class "employee" with fields name, id, designation, salary. Initialize N employees and print details of N employees. Use self and__init_() method.
23. Demonstrate on single-level and multi-level inheritance.
24. Demonstrate on operator overloading, method overloading, method overriding
25. Programs to illustrate a few built-in library functions.

Text Book:

1. Reema Thareja, *"Python programming using problem solving approach ",* Oxford university press.

References Books:

1. Mark Summerfield, "*Programming in Python 3:A Complete Introduction to the Python Language",*2nd edition, Addison-Wesley
2. Martin C. Brown*," PYTHON: The Complete Reference",* McGraw-Hill, 2001.
3. E Balagurusamy,"*Introduction to Computing and Problem Solving Using Python",* McGrawHill

Course Code	Course Title						Core/Elective
U21ESN81ME	**Workshop Practice**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**4**	**25**	**50**	**2**

Course Objectives

The objectives of this course is to impart knowledge of

- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
- To provide hands on experience about use of different engineering materials, tools, equipment's and processes those are common in the engineering field.
- To gain a good basic working knowledge required for the production of various engineering products.
- To study different hand operated power tools, uses and their demonstration.
- Adopt safety practices while working with various tools.

Course Outcomes

After completing this course, the student will be able to:

- Demonstrate an understanding of and comply with workshop safety regulations.
- Identify and apply suitable tools for different trades of Engineering processes including material removing, measuring and chiselling.
- Study and practice on machine tools and their operations
- Undertake jobs connected with Engineering Workshop trades including sheet metal and house wiring.
- Apply basic electrical engineering knowledge for house wiring practice.

A. Trade for Exercises:

Course Objective: To impart hands-on practice on basic engineering trades and skills.

1. **Carpentry**-Practice of Cross Half lap joint, Lap Dovetail joint and Briddle Joint
2. **Fitting** - Exercises - Preparation of straight fitting, semi-circular fitting and vee - fitting models
3. **House wiring-Exercises**-Single lamp, parallel/Series connection of 2 bulbs and Stair case wiring
4. **Sheet metal-**Forming and Bending. Model making. Exercises-Taper Tray, Open Scoop, Funnel.
5. **Smithy**-operations, upsetting, swaging, setting down and bending. Exercise –Round rod to Square, S-Hook, Round rod to Square headed bolt.
6. **Welding**-Introduction, Study of Tools and welding Equipment (Gas and Arc welding); Selection of welding electrode and current, Bead practice; Practice of Butt Joint, Lap Joint, Tee-Joint.
7. **Plumbing**-Practice of Internal threading, external threading, pipe bending, pipe fitting. Pipe connections with different joining components. Pipes with coupling for same diameter and with reducer for different diameters. Exercises-Practice of Tee-fitting, Union-fitting, Gate valves fitting.

B. IT WORKSHOP: Computer hardware, identification of parts, Disassembly, Assembly of computer to working condition, operating system installation.

1. System Assembling, Disassembling and identification of Parts / Peripherals
2. Operating System Installation-Install Operating Systems like Windows, Linux along with necessary Device, Drivers.
3. MS-Office / Open Office
    a) Word - Formatting, Page Borders, Reviewing, Equations, symbols.
    b) Spread Sheet - organize data, usage of formula, graphs, charts.
    c) Power point - features of power point, guidelines for preparing an effective presentation.
    d) Access- creation of database, validate data.
4. Network Configuration & Software Installation-Configuring TCP/IP, proxy and firewall settings. Installing application software, system software & tools.
5. Internet and World Wide Web-Search Engines, Types of search engines, netiquette, cyber hygiene.
6. Trouble Shooting-Hardware trouble shooting, Software trouble shooting**.**

Experiments Behind The Curriculum:

A. POWER TOOLS:

1. Study of different hand operated power tools, uses and their demonstration
2. Practice of all available Bosch Power tools.

Carpentry using Power Tools only:

a) Study of the joints in roofs, doors, windows and furniture
b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting

Text Books:

1. K. Venugopal. *"Workshop manual",* Anuradha Publications, Kumbakonam, TN, 2012
2. K.C. John, *"Mechanical Workshop"* 2ndEdn., PHI, 2010.
3. Hajra Choudary, *"Elements of Workshop Technology"* Vol. 1, Asian Publishers, Edn., 1993.
4. G.S. Sawhney, *"Mechanical Experiments and Workshop Practice",* I.K. International Publishing House, New Delhi, 2009.
5. K. L. James, Computer Hardware, *Installation, Interfacing, Troubleshooting and Maintenance*, Eastern Economy Edition

Scheme of Instruction& Examination
B.E. III –Semester
(AUTOMOBILE ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/week	CIE	SEE	Duration of in Hrs.	
Theory Courses										
1	U21HSN01CO	Finance and Accounting	3	-	-	3	30	70	3	3
2	U21BSN03MT	Engineering Mathematics-III	3	-	-	3	30	70	3	3
3	U21ES301AE	Energy Sciences and Engineering	2	1	-	3	30	70	3	3
4	U21ESN01EE	Basic Electrical Engineering	3	-	-	3	30	70	3	3
5	U21PC302AE	Fluid Mechanics	3	-	-	3	30	70	3	3
6	U21PC303AE	Engg Thermodynamics	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	U21ESN81EE	Basic Electrical Engineering Lab	-	-	2	2	25	50	3	1
8	U21PC381AE	Fluids, Oil Hydraulics &Pneumatics Lab	-	-	2	2	25	50	3	1
9	U21PC382AE	Automotive Engineering Drawing and Modeling Lab	-	-	2	2	25	50	3	1
Total			**17**	**1**	**6**	**24**	**255**	**570**		**21**

BS: Basic Science
PC: Professional Core
T: Tutorial
D: Drawing
SEE: Semester End Evaluation
ES: Engineering Science
L: Lecture
P: Practical
CIE: Continuous Internal Evaluation

Note:

1. Each contact hour is a clock hour
2. The duration ofthe practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

COURSE CODE	COURSE TITLE						CORE/ELECTIVE
U21HSN01CO	FINANCE AND ACCOUNTING						CORE
PREREQUISITE	CONTACT HOURS PER WEEK				CIE	SEE	CREDITS
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

The course will introduce the students t -

1. To provide understanding ofthe accounting aspects of business.
2. To provide understanding of financial statements.
3. To provide understanding of financial system.
4. To provide inputs necessary to evaluate the viability of projects.
5. To provide the skills necessary to analyse the financial statements.

Course Outcomes:

After successful completion of the course the students will be able -

1. To be able to evaluate the financial performance of the business unit.
2. To be able to take decisions on selection of projects.
3. To be able to take decisions o procurement of finances.
4. To be able to analyse the liquidity, solvency and profitability of the business unit.

UNIT-I

Basics of Accounting: Financial Accounting-Definition - Accounting Cycle –Journal - Ledger - Cash Book –Bank Reconciliation Statement and Trial Balance (including problems)

UNIT-II

Final Accounts: Trading Account - Profit and Loss Account - Balance Sheet (including problems with adjustments like Closing Stock, Expenses Outstanding, Prepaid Expenses, Income earned but not received, Income received in advance, Depreciation, Bad debts, Provision for Bad and Doubtful Debts, Provision for Discount on Debtors, Provision for Discount on Creditors, Interest on Capital, Interest on Drawings)

UNIT-III

Financial Statement Analysis: Importance-Users - Ratio Analysis - Liquidity, Solvency, Turnover & Profitability Ratios.

UNIT-IV

Capital Budgeting: Meaning – Importance - Time Value of Money- Discounting - Compounding - Financial Appraisal of Project – Payback Period, ARR, NPV, PI, IRR (Simple problems)

UNIT-V

Financial System and Markets: Financial System - Financial Markets – Financial Institutions –Financial Instruments – Financial Intermediaries – RBI, SEBI and IRDA (Functions only)

Suggested Readings:

1. Accountancy – I: Haneef & Mukarjee, Tata McGrahill Company
2. Accountancy – I: SP. Jain & KL. Narang, Kalyani Publishers
3. Advanced Accountancy – I: S.N. Maheshwari & V.L. Maheswari, Vikas Publishers
4. Financial Management – I.M. Pandey, Vikas Publishers
5. Financial Institutions & Markets – Prashanta Athma, PBP.

Course Code	Course Title						Core / Elective
U21BSN03MT	**Engineering Mathematics- III** (Common to All Branches)						**Core**
Prerequisite	Contact hours per week				CIE	SEE	Credits
	L	T	D	P			
-	3		-	-	**30**	**70**	3

Course Objectives:

It is intended to make the students

1. To introduce the basic concepts of probability.
2. To studythe concepts of discrete and continuous probability distributions.
3. To introduce and studythe concepts of fitting of curves, Correlation and Regression.
4. To studythe concepts of testing of hypothesis for small samples.

Course Outcomes:

After the completion of this course, the student is able to

1. Solve the problems by using the concepts of probability and random variables.
2. Determine the statistical parameters for discrete probability distributions.
3. Determine the statistical parameters for continuous probability distributions.
4. Solve problems on curve fitting, correlation and lines of regression.
5. Test the hypothesis for small samples.

UNIT-I

Probability: Introduction to Probability, Conditional Probability, Theorem of Total probability, Bayes Theorem and its applications, Random variables, Types of random variables, Probability mass function and Probability density function, Mathematical expectation, variance. (12 hours)

UNIT-II

Discrete probability distributions: Introduction to Binomial and Poisson distributions, evaluation of statistical parameters -mean, variance, moment generating function, moments, skewness and kurtosisby central moments. (9 hours)

UNIT-III

Continuous probability distributions: Introduction to Uniform, Normal distributions, evaluation of statistical parameters - mean, variance, moment generating function, moments, skewness and kurtosis by central moments, Central limit theorem (without proof) (9 hours)

UNIT-IV

Correlation and Regression: Fitting of straight-line, second-degree Parabola and Power curves. Correlation, Regression and Rank correlation. (11 hours)

UNIT-V

Tests of significance: Small Samples-Introduction, Test of Hypothesis, t-test for single mean, difference of means, F-test for ratio of variances, Chi-square test for goodness of fit (11 hours)

Prescribed text books:

1. R. K. Jain & S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publications.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications.
3. S.C. Gupta & V. K. Kapoor, "Fundamentals of Mathematical Statistics", S. Chand Pub.

Suggested Readings:

1. N. P. Bali, &M. Goyal, "A text book of Engineering Mathematics", Laxmipublications,2010.
2. P. G. Hoel, S. C. Port & C. J. Stone, "Introduction to Probability Theory", UniversalBook Stall, 2003
3. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. I, Wiley, 1968.

Course Code	Course Title						Core / Elective
U21ES301AE	Energy Sciences and Engineering						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
---	2	1	-	-	30	70	3

Course Objectives:

The objectives of this course is to impart knowledge to,

1. Enable to identify various sources of energy.
2. Understand the difference between conventional and renewable energy sources.
3. Identify various storage devices of energy.
4. Enable to estimate the costing of power plant.

Course Outcomes:

After completing this course, the student will be able to:

1. Understand the basics of various sources of energy
2. Analyze the present status of conventional energy sources.
3. Understand the working principles of renewable energysystems
4. Design and develop waste heat recovery systems.
5. Relate energyeconomics, standards and future challenges

UNIT-I

Introduction: Various sources of energy, relative merits and demerits, statistics and prospects of conventional and renewable energy sources.

UNIT-II

Conventional Energy Sources: Fossil Fuels: Power generation using steam turbine and gas turbine power plants, Nuclear Fuels: Parts of reactor core, Nuclear power plant outline, Methods to dispose radioactive waste. Hydro - Energy Spillways, Hydroelectric power plant outline.

UNIT-III

Renewable Energy Systems: Solar Energy – Types of collectors and concentrators, Solar photo voltaic cell. Wind Energy–Types of Wind Turbines and their working, geothermal power plant, Biomass conversion, Wave energy power plant, Tidal energy power plant, Ocean thermal energy power plant.

UNIT-IV

Storage: Methods to store Mechanical Energy, Electrical Energy, Chemical Energy and Thermal Energy. Co-generation &Tri-generation: Definition, application, advantages, classification, Saving potential. energy waste, waste heat recovery classification, advantages and applications, commercially viable waste heat recovery devices.

UNIT-V

Power Plant Economics and Environmental Considerations: Costing, Estimation of power production –Pollutants and Pollution Standards-Methods of pollution control. Energy Efficiency rating and BEE standards, Future energy needs and challenges.

Text Books:

1. Wakil MM, *Power Plant Technology*, McGrawHill
2. P.K.Nag, *Power Plant Engineering*, McGraw-Hill

References:

1 G.D.Rai, *Non-Conventional Energy Sources,* Khanna Publishers
2 MiliMajumdar,*Energy Efficient Buildings in India* ,Ministry of Non-Conventional Energy Sources.

Course Code	Course Title						Core/Elective
U21ESN01EE	**Basic Electrical Engineering (Common to ECE, CSE, IT, ME & AE Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	3

Course Objectives: It is intended to make the students
1. To provide an understanding of basics in Electrical circuits.
2. To explain the working principles of Electrical Machines and single-phase transformers.

Course Outcomes: After the completion of this course, the student is able to
1. Apply network theorems to solve DC and AC circuits.
2. Analyze DC and AC circuits.
3. Illustrate the construction, operation and performance of DC machines.
4. Comprehend construction and working principles of AC Machines.
5. Identify the Electrical Installation, Switchgear, Safety measures

Unit-I:

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems.

Unit-II:

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, and RL, RC, RLC combinations (series only). Three phase balanced circuits, voltage and current relations in star and delta connections.

Unit-III:

Transformers and 3-ph Induction Motors, Transformers: Electromagnetic induction, Faradays laws, statically induced emf, Lenz law, BH characteristics, ideal and practical transformer, losses and efficiency, Auto-transformer and three-phase transformer connections. **Three Phase Induction motor:** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, squirrel cage IM, slip-ring IM, Applications.

Unit-IV:

Single-phase induction motor & DC Machines, Single-phase induction motor: Construction and principle of operation, Capacitor start & capacitor run motor, applications.
DC Generators: Dynamically induced emf, Fleming's Right- and Left-hand rules, Construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications. **DC Motors:** principle of operation of DC Motor, Types of DC motors, applications.

Unit-V:

Electrical Installations: Components of LT Switch gear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries, Elementary calculations for energy consumption, power factor improvement and battery backup.

Text Books:

1. N.K. De, "Basic Electrical Engineering", Universities Press, 2015.
2. V.K.Mehta,"Basic Electrical Engineering",S.Chand Publications.
3. J.B. Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K .Kataria & Sons Publications, 2002.
4. J.B. Gupta, "Utilization of Electric Power and Electric Traction" S.K. Kataria & Sons Publications, 2010.

References:

1. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, "Basic Electrical Engineering" Tata Mc-Graw Hill, Publications, 2009.
2. Hughes, "Electrical Technology", VII Edition, International Student- on, Addison Welsey Longman Inc., 1995.

Course Code	Course Title						Core / Elective
U21 PC 302AE	Fluid Mechanics						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
---	3		-	-	30	70	3

Course Objectives:

It is intended to make the students to

1. Know various fluid properties, concepts and understand the basic concepts and principle of fluid flow.
2. Study different equations of fluid motion and fluid dynamics, Analyze flow through pipes and losses.
3. Understand the working principle of hydraulic turbines and pumps and their performance.
4. Understand the hydraulic actuators and principles of working & its circuit
5. Understand Pneumatic circuit and its operation

Course Outcomes:

After the completion of this course, the student is able to

1. Distinguish the properties of the fluids and different types of flows and analyze them
2. Understand the equations of motions and flow through the pipes.
3. Demonstrate the working principles of various turbines and working principles of various pumps and estimate their performance.
4. Demonstrate the Hydraulic circuits, applications
5. Demonstrate about the Pneumatic circuits and its applications

UNIT-I

Basic Concepts and Properties of Fluid: Definition, distinction between solid and fluid, Properties of fluids, density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension, units and dimensions.

Fluid Kinematics: Flow visualization, lines of flow, types of flow, velocity field and acceleration, Continuity equation (one and three-dimensional differential forms), Equation of streamline, stream function, velocity potential function, circulation and flow net.

UNIT-II

Fluid Dynamics: Equations of motion, Euler's equation along a stream line, Bernoulli's equation, applications. Venturimeter, Orifice meter, Pitot tube.

Flow through pipes: Darcy-Weisbach's equation, pipe roughness, friction factor, minor losses, flow through pipes in series and in parallel, power transmission.

UNIT-III

Hydraulic Turbines: Definition and classifications of Pelton turbine, Francis turbine, working principles, velocity triangles, work done, specific speed, efficiencies and performance curve for turbines.

Hydraulic Pumps: Definition and classifications, Centrifugal pump classifications, working principles, velocity triangles, specific speed, efficiency and performance curves for pumps.

Reciprocating pump: classification, working principle.

UNIT-IV

Hydraulic circuits: Introduction to Fluid power – Advantages and Applications – Fluid power systems–Types of fluids- Properties of fluids and selection–Basics of Hydraulics–Pascal's Law, Hydraulic Actuators: Cylinders– Types and construction, Application, Hydraulic cushioning– Hydraulic Motors-Control Components: Direction Control, Flow control and pressure control valves – Types, Construction and Operation– Servo and Proportional valves.

UNIT-V

Pneumatic circuits: Properties of air–Perfect Gas Laws–Compressor–Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method and Electro Pneumatic System.

Text books:

1. Modi & Seth" Hydraulic and Fluid Mechanics"–standardbookhouse,2002.
2. Bansal.R.K.,"FluidMechanicsandHydraulicsMachines",(5th edition),Laxmipublications(P)Ltd.Delhi,1995.
3. S R Majumdar, "Oil Hydraulic Systems, Principle and Maintenance" Tata McGraw-Hill

References:

1. KumarD.S.,"FluidMechanicsandFluidPowerEngineering",S.K.Kataria&Sons.
2. White,F.M.,"FluidMechanics",TataMcGraw-Hill,5thEdition,NewDelhi,2003.
3. Som,S.K.,andBiswas,G.,"Introductiontofluidmechanicsandfluidmachines",TataMcGraw-Hill,2nd edition, 2004.
4. Streeter,V.L.,andWylie,E.B.,"FluidMechanics",McGraw-Hill,1983.

Course Code	Course Title						Core / Elective
U21 PC 303AE	Engineering Thermodynamics						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Basic concepts of Engineering Physics and Engineering Mathematics	3		-	-	30	70	3

Course Objectives:

It is intended to make the students to

1. Understand Thermodynamics systems, Thermodynamics properties, energy interactions in the form of work and heat and apply first law of thermodynamics for open and closed systems
2. Understand the first law of thermodynamics for open and closed systems and steady flow energy equations, its applications
3. Understand the concept of Second law of Thermodynamics, entropy and Carnot theorem and acquire knowledge about heat engine, heat pump and refrigerator.
4. Understand the various Gas power cycles, Vapour power cycle and their principle of working. And methods of improve the performance of Rankine Cycle
5. Understand Fundamentals of Refrigeration and desirable properties of refrigerants.

Course Outcomes:

After the completion ofthis Course, the student is able to

1. Distinguish Thermodynamic systems, apply Zeroth law for temperature measurement and
2. Apply the First law of thermodynamics to closed system and understand steady flow energy equation, its applications
3. Apply second law of thermodynamics to heat engine, heat pump and refrigerator to find their performance and determine entropychanges for a closed system.
4. Distinguish the various types gas power cycles and vapour power cycles and methods to improve the Rankine cycle
5. Give about the Fundamental Refrigeration and its components and designation of refrigerants

UNIT-I:

Work & Energy: System, thermodynamic equilibrium, state, property, process, cycle, Zeroth law of thermodynamics, ideal gases, gas equation, Energy, work, heat and relations for non-flow work to thermodynamic processes such as Isobaric, Isochoric, Isothermal, Adiabatic, Poly tropic, Hyperbolic, free expansion and isenthalpic processes.

UNIT – II:

First Law of Thermo dynamics: first law of thermodynamics, PMM I, Energy property of system, concept of Internal energy, enthalpy Application of first law of thermodynamics to closed and open systems, pressure – volume diagrams, Steady flow process, application of steady flow energy equation to Boilers, turbines, Nozzles, diffusers, heat exchangers etc., numerical problems.

UNIT – III:

Second Law of Thermodynamics: Limitations of first law, statements of second law of thermodynamics, Kelvin planck & Clasius statement, equivalence, PMM II, Clausius inequality, heat engine, heat pump, refrigerator, Carnot cycle, Reversed Carnot cycle, Carnot theorem, entropy, temperature – entropydiagram, entropychanges for a closed system.

Unit – IV:

Gas Power Cycles &Vapour Power Cycles: Otto Cycle, Diesel Cycle, Dual Cycle, Comparison of Otto, Diesel and Dual cycle, Brayton cycle(joule Cycle) , properties of steam ,Rankine Cycle, Modified Rankine cycle, Regeneration & Reheating, Numerical problems.

Unit – V:

Fundamentals of Refrigeration: Fundamentals of Refrigeration, COP, reversed Carnot cycle, Simple Vapour Compression, Refrigeration system. T-S, P-H diagram and desirable properties of an ideal refrigerants. Designation of refrigerants, calculation of COP and numerical problems.

Text books:

1. P. K. Nag, “Engineering Thermodynamics”, Tata McGraw Hill, 2005.
2. R. K. Rajput, “Text book of Engineering Thermodynamics”. Laxmi Publications (p) Ltd, New Delhi, 2001.

References:

1. Fundamentals of Thermodynamics, Sixth Edition by Richard E. Sonntag, Claus Borgnakke and Gordon J. VanWylen.
2. Mahesh M Rathore, “Thermal Engineering”, McGraw Hill Education (India) Private Limited.
3. Y.V.C. Rao, “An introduction to thermodynamics”, Universities Press, 2nd edition, 2010

Van wylen“fundamentals of thermodynamics” 6th edition,2003.

Course Code	Course Title						Core/Elective
U21ESN81EE	**Basic Electrical Engineering Lab (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	**25**	**50**	1

Course Objectives: It is intended to make the students

- To impart the practical knowledge and analysis of electrical circuits, theorems and transformers.
- To impart the practical knowledge on testing of DC and AC Machines and the usage of common electrical measuring instruments.

Course Outcomes: After the completion ofthis Course, the student is able to

1. Get an exposure to common electrical components and their ratings.
2. Analyze the performance of DC and AC Circuits.
3. Analyze the performance of DC and AC Machines.
4. Comprehend the usage of common electrical measuring instruments.
5. Test the basic characteristics oftransformers and electrical machines.

Suggested List of Laboratory Experiments/ Demonstrations:

1. Demonstration of Basic safety precautions. Introduction and use of measuring instruments– voltmeter, ammeter, multi-meter, oscilloscope, Real-life resistors, capacitors and inductors.
2. Verification of KVL and KCL, superposition theorem (with DC excitation)
3. Verification of Thevenin's and Norton's theorems (with DC excitation)
4. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification of phase differences between current and voltage and Power factor calculation.
5. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
6. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
7. Three-phase transformers: Star and Delta connections, Voltage and Current relationships (line- line voltage, phase-to-neutral voltage, line and phase currents).
8. Measurement of phase voltage/ current, line voltage/ current and power in a balanced three-phase circuit connected in star and delta. Demonstration of cut-out sections of machines: DC machine, induction machine (squirrel-cage rotor), synchronous machine (field winding- slip-ring arrangement) and single-phase induction machine.
9. OC characteristics of DC Generator
10. Synchronous speed of two and four-pole, three-phase induction motors, Direction reversal by change of phase-sequence of connections.
11. Power factor improvement of Induction Motor using static capacitors
12. Load Test of DC Motor

Note: Minimum eight experiments should be conducted in the semester

Reference books:

1. J.B. Gupta, “Fundamentals of Electrical Engineering and Electronics” S.K. Kataria & Sons Publications, 2002.
2. J.B. Gupta, “Utilization of Electric Power and Electric Traction” S.K. Kataria & Sons Publications, 2010
3. Satish Kumar Peddapelli, G. Sridhar, “Electrical Machines – A Practical Approach”, De Gruyter Publications, 2020.

Hughes, “Electrical Technology", VII Edition, International Student-on, Addison Welsey Longman Inc., 1995.

Course Code	Course Title						Core / Elective
U21 PC 381AE	FLUIDS, OIL HYDRAULICS AND PNEUMATICS LAB						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Fundamental of physics	3		-	-	25	50	1

Course Objectives

It is intended to make the students to

1. Study and testing of venture meter and orifice meter in determination of coefficient of discharge
2. Know about the Reciprocating Pump, Gear pump under different speeds and evaluate their performance characteristics
3. Study and test Pelton wheel and, gear pump under different speeds and evaluate their performance characteristics
4. Studyand operate Hydraulic circuit single acting and double acting cylinder
5. Studyand operate Pneumatic circuit single acting and double acting cylinder

Course Outcomes

After the completion of this unit, the student is able to

1. Explain the working and testing of venture meter and orifice meter in determination of coefficient of discharge
2. Explain the working and test reciprocating pump, gear pump under different speeds and evaluate their performance characteristics
3. Demonstrate the working and test Francis turbine and, Impact of jet on vanes under different speeds and evaluate their performance characteristics
4. Studyand operate Hydraulic circuit single acting and double acting cylinder
5. Studyand operate Pneumatic circuit single acting and double acting cylinder

List of experiments:

1. To determine coefficient of discharge of Venture meter and Orifice meter.
2. Performance and characteristic curves of Reciprocating pump / gear pump.
3. Impact of jet on fixed flat vanes and curved vanes.
4. To determine Performance characteristic of Francis Turbine.
5. Studyof hydraulic circuits& Pneumatic Circuits.
6. Controlof a single acting cylinder with hydraulic circuit.
7. Controlof a double acting cylinder with hydraulic circuit.
8. Controlof a single acting cylinder with Pneumatic circuits
9. Controlof a double acting cylinder with Pneumatic circuits(manual)
10. Controlof a double acting cylinder with limit switches using pilot operated valve.

Note: Minimum eight experiments should be conducted in the semester

Reference books:

1. Modi & Seth" Hydraulic and Fluid Mechanics"–standardbookhouse,2002.
2. S R Majumdar, "Oil Hydraulic Systems, Principle and Maintenance" Tata McGraw-Hill

Course Code	Course Title						Core / Elective
U21PC382AE	Automotive Drawing and Modeling Lab						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
---	-		-	-	25	50	1

Objectives:

1. To understand format of drawing sheet, angle of projections, isometric projections and practice on simple Automotive elements
2. To practice free hand sketching of automotive elements
3. To understand Modeling of assembly drawings of typical automotive parts

Outcomes:

At the end of the course, the student

1. Will be able to draw isometric and orthogonal projections and sectional views of various automotive components.
2. Will be able to draw free hand sketches of various automotive components
3. Will be able to understand the shape and structure of different types of automotive components
4. Will be sufficiently knowledgeable to use the software to produce assembly views of various automotive components from part drawings.

I. Automotive Drawing (AutoCAD):

1. Format of drawing sheet, title block.
2. Conventions of drawing lines and dimensions.
3. Convention for sectional views.
4. Orthographic Projections including sectional views of simple automotive elements.

II. Modeling (SOLIDWORKS)

1. Introduction Modelling
2. Geometric modelling of simple parts (sketching).
3. Part modelling of simple parts.

III. Assembly drawing (SOLIDWORKS)

1. Piston.
2. Connecting rod.
3. Universal Coupling.
4. Screw jack.
5. Ladder frame chassis.

Note: Minimum eight experiments should be conducted in the semester

Reference books:

1. N.D. Bhatt "Machine Drawing ", Charotar Publishing House, Anand, New Delhi, 28th Edition, 1994.
2. K.L Narayana, P Kannaiah, K Venkat Reddy, "Machine Drawing ", New Age International (P) Ltd., 2nd Edition, 1999.
3. N Siddeshwar, "Machine Drawing ", Tata McGraw Hill Publishing Co. Ltd., 5th Edition, 1994.
4. K. C. John, "Text book of Machine Drawing", PHI Learning, 2010.

Scheme of Instruction& Examination
B.E. IV –Semester
(AUTOMOBILE ENGINEERING)

S.No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/week	CIE	SEE	Duration of SEE (Hrs.)	
Theory Courses										
1	U21PC401AE	Automotive Engines	3	-	-	3	30	70	3	3
2	U21PC402AE	Automotive materials &Composites	3	-	-	3	30	70	3	3
3	U21PC403AE	Mechanics of Solids	3	-	-	3	30	70	3	3
4	U21PC404AE	Automotive Chassis Components	3	-	-	3	30	70	3	3
5	U21PC405AE	Kinematics of Machines	3	-	-	3	30	70	3	3
6	U21PC406AE	Automotive Transmission & Drives	3	-	-	3	30	70	3	3
7	U21MCN01PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	3	0
Practical/ Laboratory Courses										
8	U21PC481AE	Automotive chassis Components Lab	-	-	2	2	25	50	3	1
9	U21PC482AE	Automotive Materials Testing & Composites lab	-	-	2	2	25	50	3	1
10	-	Internship *	-	-	-	-	-	-	-	-
		Total	**20**	**-**	**4**	**24**	**260**	**590**		**20**

* Internship- In plant Training/ Auto workshop training / SAE BAJA/SAE SUPRA, etc., to be conducted after the IV Semester in the Summer Vacation, which will be evaluated in V Semester.

BS: Basic Science.
PC: Professional Core.
T: Tutorial.
CIE: Continuous Internal Evaluation.
SEE: Semester end Evaluation.
ES: Engineering Science.
L: Lecture.
P: Practical.
D: Drawing.

Note:

1. Each contact hour is a clock hour.
2. The duration of the practical class is two hours; however, it can be extended wherevernecessary and to enable the student to complete the experiment.

Course Code	Course Title						Core / Elective
U21 PC401 AE	Automotive Engines						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
---	3		-	-	30	70	3

Course Objectives: It is intended to make the students

1. To understand basic principle of operation of petrol and diesel engines.
2. To understand combustion process in IC engines and know different combustion chambers,
3. To understand the working of fuel supply systems of I C Engines.
4. To understand the working of ignition, cooling and lubrication systems of IC Engines.
5. To understand the supercharging and turbo-charging and performance and emission characteristics of I C Engines.

Course Outcomes:

After the completion of this course, the student is able to

1. Demonstrate the working principle of I C Engines.
2. Explain combustion phenomenon in IC engines
3. Distinguish between fuel supply systems used for I C Engines.
4. Select suitable ignition, cooling and lubrication systems for any I C Engine.
5. Understand the supercharging/ turbo-charging method for the engines and evaluate the performance and emission characteristics of I C Engines

UNIT – I

Introduction

Introduction and Classification of I.C. Engines; Constructional details of I C engines and their materials, Cycle of operation in Four stroke and Two-stroke IC engines and their comparative study; Fuel air cycles and their analysis, Actual working cycle, Valve and port Timing Diagram.

UNIT – II

Fuels and Combustion:

Petrol Fuel: Octane number, properties of A/F mixture Combustion in SI engine: stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, detonation, effect of engine variables on knock, knock rating. Types of Combustion chambers for SI Engines.

Diesel Fuels: Properties and rating of fuels; cetane number, properties of A/F mixture,

Combustion in CI Engine: Stages of combustion, delay period, factors affecting delay period, knock in CI engines. Comparison of knock in CI & SI engines. Combustion chambers- design requirements, direct and indirect injection combustion chambers.

UNIT – III

Fuel Supply System: Spark ignition Engine mixture requirements, Fuel-Air ratio, Simple carburetor and auxiliary circuits Injection systems: Single-point and Multipoint injection and Gasoline direct injection system.

Compression Ignition Engines: Fuel Injection Systems, Air injection systems, Airless/solid injection systems, Common rail, individual pump, distributor and unit systems. Injection pumps, Fuel injector, Types of nozzles and electronically controlled fuel injection system.

UNIT – IV

Ignition System: Working of battery and magneto ignition systems, relative merits and demerits, centrifugal and vacuum advance mechanisms. Classification and construction of spark plugs, electronic fuel ignition systems.

Engine lubrication: Types of lubricants and their properties, SAE rating of lubricants, Types of lubrication systems.

Engine Cooling: Necessity of engine cooling, disadvantages of overcooling, Cooling systems and their comparison: Air cooling and liquid cooling.

UNIT – V

Supercharging/Turbo-charging: Objectives, Limitations, Methods and Types, Different arrangements of turbochargers and supercharger.

Engine Testing and Performance:

Automotive and stationary engine testing and related emission standards. Engine performance and emission characteristics, variables affecting engine performance and emission, methods to improve engine performance, heat balance and performance maps.

Text books:

1. Ganesan. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L. Mathur and R. P.Sharma "A course in Internal Combustion Engines", DhanpatRai and Sons, 2002.

References:

1. Dr.K.K. Ramalingam "Internal Combustion Engines Theory and Practice", Scitech
   a. Publications (India), Pvt. Ltd., Chennai 600 017, 2002.
2. Heywood.J. B "Internal Combustion Engine Fundamentals", McGraw-Hill Book Co., 1988.
3. Pulkrabek "Engineering Fundamentals of the Internal Combustion Engines", Practice Hall of India ,2003.

Course Code	Course Title						Core / Elective
U21PC402AE	Automotive Materials & Composites						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
---	3		-	-	30	70	3

Course Objectives:

It is intended to make the students to

1. To understand imperfections and dislocations in crystals, Types of fractures in metals, hot and cold working processes.
2. To gain a working understanding of Equilibrium diagrams.
3. To understand the structure of alloys, structure and characteristics of Ferrous and Non Ferrous metals and their use in the automobile industry.
4. To understand Heat Treatment and its significance.
5. To gain a working idea on Composite materials, their classification and manufacturing techniques.

Course Outcomes:

After the completion of this course, the student is able to

1. Identify the defects in metals and differentiate hot working and cold working, recovery, recrystallization and grain growth.
2. Construct and interpret equilibrium diagrams.
3. Construct and interpret TTT diagram and familiarize themselves with Heat Treatment processes.
4. Describe various metallic and non-metallic materials and select them for current and future use in automobiles.
5. Familiarize themselves with Composites, their classification and manufacturing techniques.

UNIT – I

Introduction to Material Science. Crystallography, Miller"s indices, Packing Efficiency, Density calculations, Imperfections and dislocations in crystals. Grains and Grain Boundaries. Effect of grain size on the properties. Critical resolved shear stress, slip and twinning, Hall-Petch equation, orange Pell effect, Cold and hot working, Bauschinger Effect, Strain Hardening, Recovery Recrystallization and Grain Growth.

Fracture: Classification, Modes, ductile and brittle fracture, Crack propagation and growth, Fracture under combined stress, Fatigue and Creep.

UNIT – II

Constitution of Alloys: Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases.

Equilibrium diagrams: Construction and interpretation of thermal equilibrium diagram.

Invariant reactions: Eutectic, Eutectoid, Monotectic, Peritectic, Peritectoid; Iron-Iron Carbide Equilibrium diagram: Construction and Interpretation. Al-Cu Phase diagram, Ti-Al Phase diagram.

Ferrous Alloys**:** Types of plain Carbon Steels, Cast Iron and their properties and characteristics.

UNIT – III

Heat Treatment and Surface Hardening: Annealing, Normalising, Hardening, Tempering, Construction and interpretation of T.T.T Curve, Austempering, Martempering and Case Hardening. Non-ferrous Metals and Alloys**:** Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys. Effect of alloying elements.

UNIT – IV

Criteria of selecting materials for automotive components such as Cylinder block, Cylinder head, Piston, Piston ring, Gudgeon pin, Connecting rod, Crank shaft, Crank case, Cam, Cam shaft, Engine valve, Gear wheel, Clutch plate, Axle bearings, Chassis, Spring, body panel radiator, brake lining tires etc. Future of materials in automotive and mobility sector such as Inconel based super alloys, Titanium based super alloys, carbon fibres and 3D woven metal textiles.

Testing of materials: Universal testing machine-tension, compression, bending and shear tests, Hardness testing- Rockwell, Brinell's and Vickers's diamond methods. Toughness measurement-Izod and Charpy methods and Torsion test.

UNIT – V

Introduction to Composites, Ceramics, Polymers, their properties and applications.
Classification of Composites based on material matrix and reinforcements. Manufacturing methods. Application of non-metals in automobiles. Future of composites in the automobile and mobility sector.

Text books:

1. "Material Science and Metallurgy for Engineers" by V D Kodgire and S V Kodgire, Everest Publishing, 43rd Edition, 2018.
2. "Introduction to physical metallurgy" by S H Avner, Tata McGraw Hill, 2nd Edition, 2017

References:

3. "Mechanical Metallurgy" by G Dieter, McGraw Hill
4. "Characterization of Composite Materials" by Hatsuo Ishida, Newnes, 2010
5. Callister"s Material Science and Engineering", R Balasubramaniam, Wiley, 2nd Edition, 2014.
6. "Engineering Materials: Polymers, Ceramics and Composites" by A.K Bhargava, Prentice Hall India, 2012.

Course Code	Course Title						Core / Elective
U21 PC403 AE	MECHANICS OF SOLIDS						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
1. Engineering Mechanics. 2. Basic Engineering Mathematics.	3	-	-	-	30	70	3

Course Objectives: It is intended to make the students

1. To understand the basic concept of stress and strains for different materials.
2. To know the mechanism of the development of shear force and bending moment in beams and the stresses in thin cylinders &spheres.
3. To studythe deflections and its applications.
4. To analyze and understand shear stress, torsional stress
5. To know the theory of simple bending, direct & bending stress and distribution of shear stress.

Course Outcomes: After the completion of this course, the student is able

1. Realize and asses the theoryof elasticity and Hooke's law
2. To analyze beams to determine shear force and bending moments
3. To solve problems on bars and to determine deflections at anypoint of the beams
4. To analyze and design structural members subjected to combined stresses
5. To analyze shear stress distribution in different sections of beams.

UNIT - I

Simple Stresses & Strains: Types of stresses & strains, Stress-Strain relations (Hooke's law), Relation between elastic constants, Volumetric strain, Composite bars.

Compound Stresses: Stresses on oblique planes, Principal stresses and Principal planes. Mohr's circle and ellipse of stresses & strains.

UNIT - II

Shear Force and Bending Moment: Construction of S.F and B.M diagrams for cantilever, simply supported beams subjected to point loads, uniformly distributed loads, and combination of these loads.

Thin Cylinders & Spheres: Derivation of formulae for longitudinal stress, Circumferential(hoop) stress, Volumetric strains, Changes in diameter and volume.

UNIT - III

Deflection of Beams: Deflections of cantilever and simply supported beams for point loads and uniformly distributed loads by Double integration method.

UNIT - IV

Torsion of Circular Shafts: Theory of pure torsion, Assumptions made, Derivation of basic torsion equation, Torsional moment of resistance, Polar section modulus, Power transmitted by shafts, combined bending and torsion.

UNIT – V

Bending stresses in Beams: Assumptions made in pure bending, Derivation of bending moment equation, Modulus of section, Moment of resistance, Determination of bending stresses. Distribution of shear stress: Equation of shear stress and Distribution across rectangular section.

Text books:

1. S. Ramamrutham, Strength of Materials, DhanpatRai& Sons,1993.
2. B.C. Punmia, Strength of Materials and Theory of Structures, Laxmi Publishers, Delhi,2000.
3. R.K. Rajput, Strength of Materials, S. Chand & Co.,2003.

References:

1. EgorP.Popov,Engineering Mechanics of Solids,PrenticeHallofIndia,NewDelhi,2001.
2. Gere & Timoshenko, Mechanics of Materials, 2nd Edition, CBS Publishers and Distributors Pvt.Ltd.
3. Ferdinand P. Beer et.al., Mechanics of Materials, Tata McGraw-Hill Publishing Co. Ltd., New Delhi,2005.

Course Code	Course Title						Core / Elective
U21PC404AE	AUTOMOTIVE CHASSIS COMPONENTS						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
---	3	-	-	-	30	70	3

Course Objectives: It is intended to make the students

1. To understand the basic concepts of structure and frame of an automobile and discuss the various types of frames used in automobiles along with their constructional details.
2. To understand constructional details and working of front axles and steering geometry.
3. To understand different types of drives used in automobiles, namely the Hotchkiss drive, torque tube drive and the final drives, components of transmission and rear axle.
4. To understand the components and working of different types of suspension system.
5. To understand the components and working of different types of brakes.

Course Outcomes: After the completion of this course, the student is able

1. To identify different types of frames and assess how loads act on different cross-sections of frames
2. To demonstrate working of front axles, steering geometry and select the materials required for them.
3. To explain different types of drives used in automobiles, namely the Hotchkiss drive, torque tube drive and the final drives, components of transmission and rear axle.
4. To explain different types of suspension systems and assess the suitability of a suspension system based on the type of vehicle
5. To explain different types of braking system and distinguish between them.

UNIT – I

Introduction: Types of chassis layout with reference to power plant locations, frames, body construction, number of wheels and drives, various types of frames, constructional details, materials and testing of vehicle frame.

UNIT – II

Front Axle and Steering System: Types of front axles, construction details, materials, front wheel geometry: caster, camber, king pin inclination, toe in toe out, Conditions for true rolling motion of wheels during steering; steering geometry, Davis steering system and Ackerman, constructional details of steering linkages, different types of steering gear boxes, steering linkages and layouts, turning radius, wheel wobble and power assisted steering.

UNIT – III

Drive Line: Effect of driving thrust and torque reactions, Hotchkiss drive, torque tube drive and radius rods, propeller shaft, universal joints, front wheel drive, different types of final drive, double reduction and twin speed final drives, differential principle, construction details of differential unit and Non-slip differential, differential locks, differential housings, construction of rear axles, types of loads acting on rear axles, fully floating, three quarter floating and semi floating rear axles, rear axle housing, construction of different types of axle housings and multi axle vehicles.

UNIT – IV

Suspension System: Need of suspension system, types of suspension, suspension springs, construction details and characteristics of leaf spring, coil spring and torsion bar springs, independent suspension, rubber suspension, pneumatic suspension and shock absorbers.

UNIT – V

Braking System: Classification of brakes, drum brakes and disc brakes, constructional details, theory of braking, concept of dual brake system, parking brake, hydraulic system, vacuum assisted system, air brake system, antilock braking system, retarded engine brakes and eddyretarders.

Text books:

1. Kirpal Singh ―Automobile Engineering- vol-1 Standard publishers,2007.
2. R.B Gupta ―Automobile Engineering- vol-1 Tech India,2007.
3. K.K. Ramalingam ―Automobile Engineering Scitech publication,2001.

References:

1. Joseph Heitner ―Automobile Mechanics, CBS Publishers, 2ndedition.
2. Crouse/ Anglin ―Automotive Mechanics Tata McGraw Hill, 9thedition

Course Code	Course Title						Core / Elective
U21 PC 405AE	KINEMATICS OF MACHINES						Core
Prerequisites	**Contact Hours Per Week**				**CIE**	**SEE**	**Credits**
Knowledge on basic 1) Engineering Mechanics 2) Engineering Mathematics 3) Engineering drawing and basic technical drafting	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives: It is intended to make the students

1. The objective of this course is to impart knowledge of simple mechanisms
2. Analysis of mechanisms.
3. Drawing displacement diagrams for followers with several types of motions.
4. Cam profile drawing for various followers.
5. Estimation of transmission of power by belts and application of various gears and gear trains.

Course Outcomes:

After completing this course, the student will be able to:

1. Understand the principles of kinematic pairs, chain sand their classification, DOF, inversions, equivalent chains and planar mechanisms.
2. Analyse the planar mechanisms for position, velocity and acceleration.
3. Design frictional systems like belt drives, rope drives, clutches, bearing sand screw threads
4. Design cam sand followers for specified motion profiles.
5. Evaluate gear tooth geometryand select appropriate gears for the required applications.

UNIT– I

Simple Mechanisms: Definition of link, pair, kinematic chain, mechanism and machine, Kutzbach and Grubler criterion, Grashoff's law, inversions of quadratic cycle chain, inversions of single and double slider crank chains. Fundamentals of coupler curves, Robert's law, Pantograph, Geneva mechanism, Hooke's joint, Davis and Ackerman's Steering gear mechanisms. Introduction to Type, Number and Dimensional synthesis of four bar planar mechanisms.

UNIT– II

Analysis of Mechanisms.

Instantaneous center, body centroid and space centroid, Kennedy,, s theorem, Graphical methods (relative velocity method, instantaneous center method) to find velocities and accelerations including, Coriolis component of acceleration of planar mechanisms. Angular velocity theorem**.**

UNIT– III

Laws of Friction: Friction in screw threads, pivots, collars and clutches, friction axis of link and friction circle

Belts and Rope drives: Open and closed belt drives, length of belt, ratio of tensions, effect of centrifugal tension and initial tension on power transmission and condition for maximum power transmission

Brakes: Block or shoe brake, internal expanding shoe brake, disc brake and belt brakes

Dynamometers: Rope brake, belt transmission and torsion type dynamometers

UNIT– IV

Cams: Types of cams and followers, Displacement, velocity, acceleration and jerk (SVAJ)diagrams for follower motion, Analysis of uniform motion, parabolic motion, simple harmonic motion and cycloidal motion profiles. Graphical synthesis of planar cams with knife edge, roller and flat face followers. Eccentric circle come with translating roller follower.

UNIT – V

Gears: Classification of gears. Spur gears - Nomenclature, law of gear tooth action, involute as gear tooth profile, interference of involute gears, minimum number of teeth to avoid interference, contact ratio, cycloidal tooth profile, comparison of involute and cycloidal tooth profile.

Helical gears: Helical gear tooth relations, contact of helical gear teeth.
Gear trains-Simple, compound, reverted, and epicyclic gear trains

Text books:

1. S.S. Rattan, Theory of Machines, TataMcGraw-Hill,3rdEdition,2009.
2. Thomas Bevan, Theory of Machines, CBS Publishers

References:

1. J.E.Shigley,TheoryofMachinesandMechanisms,McGraw-HillPublications,2005.
2. Norton RL, Kinematics and Dynamics of Machinery, McGraw-Hill Publications
3. Amitabha Ghosh and Ashok Kumar Mallik, Theory of Mechanisms and Machines, East West Press Pvt. Ltd,2008.

Course Code	Course Title						Core / Elective
U21PC406AE	Automotive Transmission & Drives						Core
Prerequisites None	**Contact Hours Per Week**				**CIE**	**SEE**	**Credits**
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives: It is intended to make the students

1. To understand working principle of Clutches.
2. To understand construction, working and classification of gear box and troubleshooting aspects
3. To understand construction working, of fluid flywheel and torque converter
4. To know about automatic transmission systems and their applications.
5. To know the concepts of hydrostatic drive and electric drive

Course Outcomes: After completing this course, the student will be able

1. To know construction, working and types of clutches with trouble shooting aspects.
2. To know and analyse the construction, working and classification of gear box with trouble shooting aspects
3. To Explain the working, scope and significance of fluid flywheel and torque converter.
4. To Understand the scope and working of automatic transmission systems.
5. To Understand hydrostatic drive and electric drive and their application

UNIT-I

Clutch: Need of clutch, requirements, materials, different types of clutches, principle of friction clutches, single plate, multi-plate, diaphragm, cone, centrifugal clutch, method of actuation; electromagnetic, hydraulic, vacuum, clutch adjustment, clutch trouble shooting diagnosis and numerical problems.

UNIT-II

Gear Box: Functions of transmissions, necessity of gear box, gears, gear ratio and torque, types of transmission; manual and automatic transmission, sliding-mesh gear box, constant-mesh gear box, synchromesh gear box, transfer box, transaxle. Selector mechanism, gearbox lubrication. Calculation of gear ratios for vehicles, performance characteristics in different gears, troubleshooting diagnosis and servicing and maintenance of manual transmission and transaxle.

UNIT-III

Hydrodynamic Transmission Fluid Coupling: Understand Fluid coupling- principles- performance characteristics- advantages and limitations, construction details, torque capacity and slip in fluid coupling.

Torque Converter

Principal of torque conversion, single, multi stage and poly phase torque converters, automotive torque converter arrangements, performance characteristics, constructional and operational details of typical hydraulic transmission drives.

UNIT-IV

Automatic Transmission: Spur and internal gear type planetary gearboxes, Relative merits and demerits when compared to conventional transmission, automatic control of gears, study of typical automatic transmissions, and automatic control of gear box. Continuously Variable Transmission (CVT)-types-Operations.

UNIT-V

Hydrostatic Drives: Principle of hydrostatic drives, different systems of hydrostatic drives, Types of pumps, advantages and limitations of typical hydrostatic drives.
Electric Transmission: General arrangement and description of electric transmission, their working principle and control mechanisms and limitations

Text books:

1. K.M. Gupta, Automobile Engineering, Volume 1, Umesh Publications, 2001
2. Crouse & Anglin, "Automotive Mechanics" McGraw hill, 10th edition

References:

1. Heldt P.M - Torque converters- Chilton Book Co.-1992.
2. Newton and Steeds - Motor Vehicle- Illiffee Publisher- 2000
3. Design Practices, passenger Car Automotive Transmissions- SAE Hand book- 1994

Course Code	Course Title						Core / Elective
U21MCN01PY	Essence of Indian Traditional Knowledge (Common to CSE, IT, Civil, ECE, EEE, Mech & Auto)						Mandatory Course
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Nil	2	-	-	-	30	70	0

Course Objectives: It is intended to make the students

1. To gain knowledge in Indian Culture and Philosophy
2. To know Indian Languages and Literature and the fine arts of India
3. To make students understand the gradual exploration of the Sciences and the contributions of Scholars of Ancient, Medieval and Modern India

Course Outcomes:

1. Understand Indian philosophyand culture.
2. Identify the various Indian languages and the literature available in them.
3. Realize the rationality behind Vedic Sciences.
4. Acquire the information about the Indian fine arts and Cultural Heritage.
5. Know the evolution of Indian education system and the contributions of scientists of Different eras.

UNIT-1: INDIAN CULTURE

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT–2: INDIAN LANGUAGES & LITERATURE

Indian Languages, Culture and Literature: Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India. Indian Languages and Literature-II: Northern Indian languages & literature.

UNIT-3: ESSENCE OF VEDIC SCIENCES

Scientific approach (Mathematics: Baudhayana Sulvasutra; Geography: Mahasankalpa; Astronomy: Bruhat samhit) in Vedic Literature and proper understanding of Indian Religious literature (dashopanishats) & Practices (Meaning of mahasankalpa,Vastugunadeepika). Western understanding of Indian philosophy. Reform Movements in Modern India (Bhakti & Sufi movements & Reforms of Raja Rammohan Roy, Dayananda Saraswati, Swamy Vivekananda, Aligarh movement and Jyoti Rao pule only).

UNIT-4: INDIAN FINE ARTS

Fine Arts in India (Art, Technology & Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT- 5: EVOLUTION OF EDUCATION SYSTEM IN INDIA

Education System in India: Education in ancient, medieval and modern India, aims of education. Subjects and languages taught in various periods. Sciences and Scholars of Ancient India, Medieval India, and Scientists of Modern India.

Text books:

1. Kapil Kapoor, „Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005
2. „Science in Samskrit", Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007.
3. NCERT, "Position paper on Arts, Music, Dance and Theatre" NCERT, New Delhi, 2010.

Reference books:

1. P. Priyadarshi,"Zero is not the only story", India First Foundation,ISBN:81-89072-14-5,2007.
2. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, NewDelhi, 1989.
3 M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, New Delhi, 2005.

Course Code	Course Title						Core / Elective
U21PC481AE	AUTOMOTIVE CHASSIS COMPONENTS LAB						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	25	50	1

Objectives:

It is intended to make the students to

1. Know the constructional details of automobile frame, front&rear axles
2. Work on different types of clutches, differential, gear boxes, brakes, suspensions systems used in automobiles along with their components
3. Assembling and disassembling of clutches, front axle, rearaxle, steering, braking, Suspension system sand differential gearbox

Outcomes:

After completing this course, the student will be able to:

1. Identifythe different automotive components.
2. To identify, assemble and dissemble different types of Braking system and distinguish between them.
3. To identify, assemble and dissemble different types of suspension systems.
4. To demonstrate working of steering, front axle sand rear axles.
5. To demonstrate working ofthe clutches, suspension systems and differential gearbox

List of Experiments:

1. Studyand measurement of Light Motor Vehicle frame.
2. Studyand measurement of Heavy-DutyVehicle frame.
3. Disassembling, Assembling and calculation of turning circle radius for the given front axle
4. Disassembling and assembling of rear axle
5. Disassembling, Assembling and calculation of final gear reduction ratio for the given differential.
6. Disassembling, Assembling and calculation of gear ratio for the given steering gear box.
7. Disassembling and Assembling of Braking Systems: Hydraulic, Servo Vacuum and compressed air brakes.
8. Study, Disassembling and Assembling of Leaf Spring, coil spring, torsion bar spring, and hydraulic shock absorber.
9. Study, Disassembling and Assembling of different types of clutches.
10. Disassembling, Assembling and calculation of gear ratio for the given Gear Box
11. Studyof Transfer Case assembly.

Note: Minimum eight experiments should be conducted in the semester

Reference books:

1. Kirpal Singh —Automobile Engineering- vol-1 Standard publishers,2007.
2. R.B Gupta —Automobile Engineering- vol-1 Tech India,2007.
3. K.K. Ramalingam —Automobile Engineering Scitech publication,2001.

Course Code	Course Title						Core / Elective
U21PC482AE	Automotive Materials Testing &Composites Lab						Core
Prerequisites	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
	-	-	-	2	25	50	1

Course Objectives

It is intended to make the students to

1. To know and understand the experiments on various materials to assess their behavior /limitations.
2. To understand the Shear force, bending moment and deflections of different types of beams.
3. To know the structure of Ferrous and Non-Ferrous materials, properties and their practical applications.
4. To understand the heat treatment process of steel.
5. To gain a working understanding on the properties of Composite materials

Course Outcomes:

After the completion of this unit, the student can

1. Prepare specimen for metallographic observation.
2. Analyse and identify low, medium, and high carbon steels, distinct types of cast irons, non-ferrous alloys, from the studyof their microstructure.
3. Underlines the importance of grain size in evaluating the desired mechanical properties.
4. Correlate the heat treatment methods and the mechanical properties obtained.
5. Analyses and identify microstructures after annealing, normalizing, hardening, and tempering
6. Prepare composite samples for experiments and determine their physical properties.

List of Experiments

1. To determine Young „s modulus of Mild Steel by direct tension test
2. To determine tensile properties such as Tensile Strength, Modulus of Elasticity, Percent Elongation of plastics and composites by using a Universal Testing Machine.
3. To determine the hardness of given sample of metal using Brinell„s and Rockwell „s hardness tests
4. To determine the compressive strength of given sample of bricks.
5. To study the behavior of mild steel when subjected to a gradually increasing torque and to determine the modulus of rigidity of the given material.
6. To determine resistance to breakage by flexural shock of plastics
7. Procedure of metallurgical specimen preparation
8. Metallographic studyand analysis of Cast Iron Alloys and Steels
9. Metallographic study and analysis of non-ferrous alloys like: Brass, Bronze, Al—Si alloys, Aluminum, Babbit and Titanium Alloys.
10. Demonstration of heat treatment process and study of microstructure after hardening, normalizing and annealing of steel specimen.
11. To identify the distinct phases and to draw the microstructures of metal matrix composite

Note: Minimum eight experiments should be conducted in the semester

Reference books:

1. "Material Science and Metallurgy for Engineers" by V D Kodgire and S V Kodgire, Everest Publishing, 43rd Edition, 2018.
2. "Introduction to physical metallurgy" by S H Avner, Tata McGraw Hill, 2nd Edition, 2017
3. "Mechanical Metallurgy" by G Dieter, McGraw Hill