Regulations 2021 Curriculum and Syllabi (I & II Semesters)

B.Tech.
(Biotechnology)

REGULATIONS 2021

CURRICULUM AND SYLLABI (I & II Semesters)

B.TECH. BIOTECHNOLOGY

VISION AND MISSION OF THE INSTITUTION

VISION

B.S.Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research, and Innovation.

SCHOOL OF LIFE SCIENCES

VISION AND MISSION

VISION

To attain new heights in biotechnology research, shaping life sciences into a premier precision tool for the future for creation of wealth and ensuring social justice-specially for the welfare of the poor

MISSION

The mission of the school of life sciences and Technology is to maximize the benefits of biotechnology to the University, the nation and the globe by being an excellent quality, comprehensive, multidisciplinary school that supports, coordinates, disseminates and advances biotechnology in the areas of social welfare and entrepreneurship.

PROGRAMME EDUCATIONAL OBJECTIVES ANDOUTCOMES

B.Tech. (Biotechnology)

PROGRAMME EDUCATIONAL OBJECTIVES:

- This course will facilitate the graduates to be professionally competent in Biotechnology to solve the problems in environmental, food, biochemical and biomedical sciences.

- This course will offer students with a solid foundation in Biological Sciences, to enable them to work on applications in biotechnology as per the requirement of the industries, and also will enable the students to pursue higher studies and research.

- This course will enable students to acquire knowledge on the fundamentals of Biochemistry, Cell biology, Microbiology and Molecular biology to enable them to understand basic concept in modern biology and help them to build their carrier in this field.
- This course will facilitate the students to acquire knowledge in skill-based courses such as Biofertilizer Technology, Agricultural Biotechnology, Medical Biotechnology, Herbal Technology, Disease Management and Mushroom Culture Technology enabling their skills and give confidence to them for business opportunities.

- This programme will teach students the importance of Bioethics, entrepreneurship, communication, and management skills.

- This course will also offer the graduates to demonstrate their proficiency in theory and practice of bio-techniques through life-long learning and provide confidence to perform as an individual and / or member of a team with professional and ethical behavior.

PROGRAMME OUTCOMES:

1. Having an ability to apply mathematics and science in engineering applications.
2. Having a clear understanding of the subject related concepts and of contemporary issues and apply them to identify, formulate and analyse complex engineering problems.
3. Having an ability to design a component or a product applying all the relevant standards and with realistic constraints, including public health, safety, culture, society and environment
4. Having an ability to design and conduct experiments, as well as to analyse and interpret data, and synthesis of information
5. Having an ability to use techniques, skills, resources and modern engineering and IT tools necessary for engineering practice
6. Having problem solving ability- to assess social issues (societal, health, safety, legal and cultural) and engineering problems
7. Having adaptive thinking and adaptability in relation to environmental context and sustainable development
8. Having a clear understanding of professional and ethical responsibility
9. Having cross cultural competency exhibited by working as a member or in teams
10. Having a good working knowledge of communicating in English and communicate effectively on complex science activities with the science community and with the society at large.
11. Having a good cognitive load management skills related to project management and finance
12. Having interest and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES:

On completion of B. Tech. Biotechnology programme, graduates will be able to

1. Apply knowledge to find innovative solutions for biotechnological problems
2. Explore problems related to biotechnology and provide valid conclusions through industry academia interface
3. Infer the potentials and impact of biotechnological innovations for finding sustainable ethical solutions to issues pertaining to health, environment and agriculture

REGULATIONS - 2021
B.TECH. DEGREE PROGRAMMES
(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means B.Tech. Degree Programme.

ii) **"Branch"** means specialization or discipline of B.Tech. Degree Programme like Civil Engineering, Mechanical Engineering, etc.,

iii) **"Course"** means theory / practical / laboratory integrated theory / seminar / internship / project and any other subject that is normally studied in a semester like English, Mathematics, Environmental Science, Engineering Graphics, Electronic Devices etc.,

iv) **"Institution"** means B.S. Abdur Rahman Crescent Institute of Science and Technology.

v) **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this Institute.

vi) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) ofthe Institution who is responsible for the implementation of relevant rules and regulations for all the academic activities.

vii) **"Dean (Student Affairs**)" means the Dean (Students Affairs) of the Institution who is responsible for activities related to student welfare and discipline in the campus.

viii) **"Controller of Examinations"** means the Controller of Examinations ofthe Institution who is responsible for the conduct of examinations and declaration of results.

ix) **"Dean of the School"** means the Dean of the School of the department concerned.

x) **"Head of the Department"** means the Head of the Department concerned.

2.0 ADMISSION

2.1a) Candidates for admission to the first semester of the eight semester B. Tech. degree programme shall be required to have passed the Higher Secondary Examination of the 10+2 curriculum

(Academic stream) prescribed by the appropriate authority or any other examination of any University or authority accepted by the Institution as equivalent thereto.

2.1b) The student shall have studied at least any three of the following courses: Physics, Mathematics, Chemistry, Computer Science, Electronics, Information Technology, Biology, Informatics Practices, Biotechnology, Technical Vocational Subjects, Agriculture, Engineering Graphics, Business Studies, Entrepreneurship at 10+2 level. In case if the student has not studied any or all the courses viz., mathematics, physics and chemistry, he / she shall undergo bridge course(s) in the concerned course(s) at 10+2 level knowledge.

2.2 Notwithstanding the qualifying examination, the candidate might have passed at 10+2, the candidate shall also write an entrance examination prescribed by the Institution for admission. The entrance examination shall test the proficiency of the candidate in the courses considered eligible for admission on the standards prescribed for 10+2 academic stream.

2.3 Candidates for admission to the third semester of the eight semester B.Tech.programme under lateral entry category shall be required to have passed minimum Three years / Two years (Lateral Entry) Diploma examination in any branch of Engineering / Technology or passed B.Sc. Degree from a recognized University as defined by UGC and passed 10+2 examination with Mathematics as a subject or Passed three year Diploma of Vocation Stream (D.Voc) in the same or allied sector or any other examination of any other authority accepted by the Institution as equivalent thereto.

2.4 The Institution shall offer suitable bridge courses in Mathematics, Physics, Engineering drawing, etc., for the students of diverse backgrounds.

2.5 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Institution in adherence to the guidelines of regulatory authorities from time to time.

3.0 BRANCHES OF STUDY

3.1 Regulations are applicable to the following B.Tech. Degree

programmes in various branches of Engineering and Technology, each distributed over eight semesters, with two semesters per academic year.

1. Aeronautical Engineering
2. Artificial Intelligence and Data Science
3. Automobile Engineering
4. Biotechnology
5. Civil Engineering
6. Computer Science and Engineering
7. Computer Science and Engineering (Cyber Security)
8. Computer Science and Engineering (Internet of Things)
9. Electrical and Electronics Engineering
10. Electronics and Communication Engineering
11. Electronics and Instrumentation Engineering
12. Information Technology
13. Mechanical Engineering
14. Polymer Engineering

4.0 STRUCTURE OF THE PROGRAMME

4.1 Every programme has a curriculum with syllabi consisting of theory and practical courses such as,

i)   Basic Science Courses - BSC
ii)   Humanities and Social Sciences including Management Courses - HSC
iii)   Engineering Science Courses - ESC
iv)   Professional Core Courses - PCC
v)   Professional Elective Courses - PEC
vi)   Open Elective Courses - OEC
vii)   Laboratory Courses– LC
viii)   Laboratory Integrated Theory Courses – LITC
ix)   Mandatory Courses- MC
x)   Project - PROJ (Project work, seminar and internship in industry or at appropriate workplace)

4.1.1 Mandatory Induction Programme for First year Students

The first year students upon admission shall undergo a mandatory three week induction programme consisting of physical activity, creative arts, universal human values, literary,

proficiency modules, lectures by eminent people, visits to local areas, familiarization with departments / schools and centres, etc.,

4.1.2 Personality and Character Development

All students shall enroll, on admission, in any of the following personality and character development programmes:

- National Cadet Corps (NCC)
- National Service Scheme (NSS)
- National Sports Organization (NSO)
- Youth Red Cross (YRC)
- Rotaract Club - Crescent
- Crescent Indian Society Training Development(ISTD–C)
- Crescent Creative Strokes
- Crescent Technocrats club

The training activities / events / camp shall normally be organized during the weekends / vacation period.

4.1.3 Online Courses for Credit Transfer

Students are permitted to undergo department approved online courses under SWAYAM up to 20% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean (Academic Affairs) during his / her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

4.1.4 Value Added Courses

The students are permitted to pursue department approved online courses (excluding courses registered for credit transfer) or courses offered / approved by the department as value added courses.

The details of the value added course viz., syllabus, schedule of classes and the course faculty shall be sent to the Dean (Academic Affairs) for approval. The students may also undergo the valued added courses offered by other departments with the consent of the Head of the Department offering the course.

These value added courses shall be specified in the consolidated mark sheet as additional courses pursued by the student over and above the curriculum during the period of study.

4.1.5 Industry Internship

The students shall undergo training for a period as specified in the curriculum during the summer vacation in any industry relevant to the field study.

The students are also permitted to undergo internship at research organizations / eminent academic institutions for the period prescribed in the curriculum during the summer vacation, in lieu of Industrial training.

In any case, the student shall obtain necessary approval from the Head of the Department / Dean of School and the training has to be taken up at a stretch.

4.1.6 Industrial Visit

The student shall undergo at least one industrial visit every year from the second year of the programme. The Heads of Departments / Deans of Schools shall ensure the same.

4.2 Each course is normally assigned certain number of credits:

- one credit per lecture period per week
- one credit per tutorial period per week
- one credit for two to three periods and two credits for four periods of laboratory or practical sessionsper week
- one credit for two periods of seminar / project work per week
- one credit for two weeks of industrial training or 80 hours per semester.

4.3 Each semester curriculum shall normally have a blend of lecture courses, laboratory courses, laboratory integrated theory courses, etc.

4.5 The medium of instruction, examinations and project report shall be in English, except for courses in languages other than English.

5.0 DURATION OF THE PROGRAMME

5.1 A student is expected to complete the B.Tech. programme in eight semesters (six semesters in the case of lateral entry scheme), but in any case not more than 14 continuous semesters reckoned

from the date of first admission (12 semesters in the case of lateral entry students).

5.2 Each semester shall consist of a minimum of 90 working days including the days of examinations.

5.3 The maximum duration for completion of the programme as mentioned in clause 5.1 shall also include period of break of study vide clause 7.1 so that the student may be eligible for the award of the degree.

6.0 REGISTRATION AND ENROLLMENT

6.1 The students of first semester shall register and enroll for courses at the time of admission by paying the prescribed fees. For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

6.2 Change of a Course

A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

6.3 Withdrawal from a Course

A student can withdraw from an enrolled course at any time before the first continuous assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.0 BREAK OF STUDY FROM PROGRAMME

7.1 A student may be allowed / enforced to take a break of study for two semesters from the programme with the approval of Dean (Academic Affairs) for the following reasons:

7.1.1 Medical or other valid grounds

7.1.2 Award of 'I' grade in all the courses in a semester due to lack of attendance

7.1.3 Debarred due to any act of indiscipline

7.2 The total duration for completion of the programme shall not exceed theprescribed maximum number of semesters (vide clause 5.1).

7.3 A student who has availed a break of study in the current semester (odd/even) can rejoin only in the subsequent corresponding

(odd/even) semester in the next academic year on approval from the Dean (Academic affairs).

7.4 During the break of study, the student shall not be allowed to attend any regular classes or participate in any activities of the Institution. However, he / she shall be permitted to enroll for the 'I' grade courses and appear for the arrear examinations.

8.0 CLASS ADVISOR AND FACULTY ADVISOR

8.1 Class Advisor

A faculty member shall be nominated by the Head of the Department as class advisor for the class throughout the period of study except first year.

The class advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

However, for the first and second semester, the class advisors (first year class advisors) are nominated by the first year coordinator.

8.2 Faculty Advisor

To help the students in planning their courses of study and for general counseling, the Head of the Department of the students shall attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

9.0 COURSE COMMITTEE

9.1 Each common theory course offered to more than one group of students shall have a "Course Committee" comprising all the course faculty teaching the common course with one of them nominated as a course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending on whether all the course faculty teaching the common course belong to a single department or from several departments. The course committee shall ensure preparation of a common question paper and   scheme of

evaluation for the tests and semester end examination.

10.0 CLASS COMMITTEE

A class committee is constituted branch wise and semester wise by the Head of the Department / Dean of the School shall normally comprise of faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman.

10.1 The composition of class committees for first and second semester is as follows:

   i)   The first year coordinator shall be the chairman of the class committee

   ii) Faculty members of all individual courses of first / second semester

   iii) Six student representatives (male and female) of each class nominated by the first year coordinator

   iv) The class advisor and faculty advisors of the class

10.2 The composition of the class committee for each branch from 3rd to 8th semester is as follows:

   i)   One senior faculty member preferably not handling courses for the concerned semester appointed as chairman by the Head of the Department

   ii) All the faculty members handling courses of the semester

   iii) Six student representatives (male and female) of each class nominated by the Head of the Department in consultation with the relevant faculty advisors

   iv) All faculty advisors and the class advisors

   v) Head of the Department

10.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the components of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

10.4 During these two meetings, the student members shall meaningfully interact and express opinions and suggestions to

improve the effectiveness of the teaching-learning process, curriculum and syllabi, etc.

10.5 The third meeting of the class committee, excluding the student members, shall meet after the semester end examinations to analyse the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the course facultyconcerned.

11.0 CREDIT LIMIT FOR ENROLLMENT & MOVEMENT TO HIGHER SEMESTER

11.1 A student can enroll for a maximum of 32 credits during a semester including Redo / Predo courses.

11.2 The minimum credits earned by the student to move to 7th semester shall not be less than 60 credits (40 credits for lateral entry students).

12.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Course Coverage in Weeks	Duration	Weightage of Marks
Assessment 1	1 to 6	1.5 hours	25%
Assessment 2	7 to 12	1.5 hours	25%
Semester End Examination	Full course	3 hours	50%

12.2 Theory Course

Appearing for semester end theory examination for each course is mandatory and a student shall secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

12.3 Laboratory Course

Every practical course shall have 60% weightage for continuous assessments and 40% for semester end examination. However, a student shall have secured a minimum of 50% marks in the

semester end practical examination for the award of pass grade.

12.4 Laboratory Integrated Theory Courses

For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory components shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination. The evaluation of practical components shall be through continuous assessment.

12.5 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

12.6 Industry Internship

In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research / academic organisation. The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.

12.7 Project Work

In the case of project work, a committee of faculty members constituted by the Head of the Department / Dean of the School will carry out three periodic reviews. Based on the project report submitted by the students, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by the Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the viva voce examination.

12.8 Assessment of seminars and comprehension shall be carried out by a committee of faculty members constituted by the Head of the

Department.

12.9 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall become invalid.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end examination for theory component. There shall be no arrear or improvement examination for lab components.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of the School for that purpose. There is no substitute examination for semester end examinations.

13.2 A student shall apply for a substitute exam in the prescribed form to the Head of the Department / Dean of the School within a week from the date of assessment test. However, the substitute examination will be conducted only after the last instructional day of the semester.

14.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

14.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% to become eligible to appear for the semester end examination in that course, failing which the student shall be awarded "I" grade in that course.

14.2 The faculty member of each course shall cumulate the attendance

details for the semester and furnish the names of the students who have not earned the required attendance in the concerned course to the class advisor. The class advisor shall consolidate and furnish the list of students who have earned less than 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of the School. Thereupon, the Dean (Academic Affairs) shall officially notify the names of such students prevented from writing the semester end examination in each course.

14.3 If a student secures attendance between 65% and less than 75% in any course in a semester, due to medical reasons (hospitalization / accident / specific illness) or due to participation in the institution approved events, the student shall be given exemption from the prescribed attendance requirement and the student shall be permitted to appear for the semester end examination of that course. In all such cases, the students shall submit the required documents immediately after joining the classes to the class advisor, which shall be approved by the Head of the Department / Dean of the School. The Vice Chancellor, based on the recommendation of the Dean (Academic Affairs) may approve the condonation of attendance.

14.4 A student who has obtained an "I" grade in all the courses in a semester is not permitted to move to the next higher semester. Such students shall repeat all the courses of the semester in the subsequent academic year.

14.5 The student awarded "I" grade, shall enroll and repeat the course when it is offered next. In case of "I" grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of the Head of the Department / Dean of the School.

14.6 A student who is awarded "U" grade in a course shall have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to redo the course when the course is offered by the department. Marks scored in the continuous assessment in the redo course shall be considered for grading along with the marks scored in the semester end (redo) examination. If any student obtains "U" grade in the redo course,

the marks scored in the continuous assessment test (redo) for that course shall be considered as internal mark for further appearance of arrear examination.

14.7 If a student with "U" grade, who prefers to redo any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she is not permitted to write the semester end examination and his / her earlier "U" grade and continuous assessment marks shall continue.

15.0 REDO COURSES

15.1 A student can register for a maximum of three redo courses per semester without affecting the regular semester classes, whenever such courses are offered by the concerneddepartment, based on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

15.2 The number of contact hours and the assessment procedure for any redo course shall be the same as regular courses, except there is no provision for any substitute examination and withdrawal from a redo course.

16.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

16.1 All assessments of a course shall be made on absolute marks basis. The class committee without the student members shall meet to analyse the performance of students in all assessments of a course and award letter grades following the relative grading system. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	-

I	-

"W" - denotes withdrawal from the course

"I" **-** denotes inadequate attendance in the course and prevention from appearance of semester end examination

"U" - denotes unsuccessful performance in the course.

16.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

16.3 Upon awarding grades, the results shall be endorsed by the chairman of the class committee and Head of the Department / Dean of the School. The Controller of Examinations shall further approve and declare the results.

16.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee, through proper application to the Controller of Examinations. Subsequently, the Head of the Department / Dean of the School offered the course shall constitute a revaluation committee consisting of chairman of the class committee as convener, the faculty member of the course and a senior faculty member having expertise in that course as members. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

16.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from the first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the ith course and GP_i is the Grade Point in the ith course,

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n}C_i}$$

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

"I" and "W" grades are excluded for calculating GPA.

"U", "I" and **"W"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks shall be as follows:

Percentage equivalent of marks = CGPA X 10

16.6 After successful completion of the programme, the degree shall be awarded to the students with the following classifications based on CGPA.

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the prescribed period of 8 semesters for all students (except lateral entry students) and 6 semesters for lateral entry students
First Class	6.50 and above and completing the programme within a maximum of 10 semesters for all students (except lateral entry students) and 8 semesters for lateral entry students
Second Class	Others

16.6.1 Eligibility for First Class with Distinction

- A student should not have obtained 'U' or 'I' grade in any course during his/her study
- A student should have completed the UG programme within the minimum prescribed period of study (except clause 7.1.1)

16.6.2 Eligibility for First Class

- A student should have passed the examination in all the

courses not more than two semesters beyond the minimum prescribed period of study (except clause 7.1.1)

16.6.3 The students who do not satisfy clause 16.6.1 and clause 16.6.2 shall be classified as second class.

16.6.4 The CGPA shall be rounded to two decimal places for the purpose of classification. The CGPA shall be considered up to three decimal places for the purpose of comparison of performance of students and ranking.

17.0 SUPPLEMENTARY EXAMINATION

Final year students and passed out students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise, students with less credits in VI semester can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in the even semester.

18.0 DISCIPLINE

18.1 Every student is expected to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

18.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the Head of the Department / Dean of the School concerned shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action. This committee shall also address the grievances related to the conduct of online classes.

19.0 ELIGIBILITY FOR THE AWARD OF DEGREE

19.1 A student shall be declared to be eligible for the award of B.Tech. degree provided the student has:

i) Successfully earned the required number of total credits as specified in the curriculum of the programme of study within a maximum period of 14 semesters (12 semesters for lateral entry) from the date of admission, including break of study.

ii) Successfully completed the requirements of the enrolled professional development activity.

iii) No dues to the Institution, Library, Hostel, etc.

iv) No disciplinary action pending against him/her.

19.2 The award of the degree must have been approved by the Institution.

20.0 MINOR DEGREE PROGRAMMES OFFERED FOR STUDENTS

20.1 The students admitted in the following B.Tech. programmes can graduate with a minor degree, which is optional, along with a major degree:

• Civil Engineering	• Mechanical Engineering
• Electronics and Communication Engineering	• Electrical and Electronics Engineering
• Automobile Engineering	• Aeronautical Engineering
• Polymer Engineering	• Biotechnology Engineering
• Electronics and Instrumentation Engineering	• Computer Science and Engineering
• Information Technology	• Artificial Intelligence and Data Science
• Computer Science and Engineering (IoT)	• Computer Science and Engineering(Cyber Security)

20.2 The eligibility for choosing the minor degree is given as below:

Sl. No.	Minor Degree	Eligible Major Degree Programmes (from other Departments)
1.	Artificial Intelligence and Machine Learning	Mechanical Engineering Aeronautical Engineering
2.	Block Chain	Polymer Engineering
3.	Cyber Security	Automobile Engineering
4.	Data Science	Civil Engineering
5.	Internet of Things (IoT)	Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering
6.	Virtual and Augmented Reality	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering Electronics and Communication Engineering

7.	Sensor Technology	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical and Electronics Engineering
8.	Robotics	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Civil Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering
9.	3D Printing	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering Electronics and Communication Engineering
10.	Electric Vehicles	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Civil Engineering Biotechnology Electronics and Communication Engineering
11.	Industrial Automation	Artificial Intelligence and Data Science Computer Science and Engineering(Cyber Security)

		Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electronics and Communication Engineering
12.	GIS and Remote Sensing	Artificial Intelligence and Data Science Computer Science and Engineering(Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Biotechnology Electrical and Electronics Engineering Electronics and Instrumentation Engineering Electronics and Communication Engineering
13.	Computational Biology	Artificial Intelligence and Data Science Computer Science and Engineering (Cyber Security) Computer Science and Engineering (IoT) Computer Science and Engineering Information and Technology Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Electrical and Electronics EngineeringElectronics and Instrumentation Engineering Electronics and Communication Engineering

20.3 A student shall earn an additional 18 to 20 credits for the award of a minor degree.

20.4 A student shall be awarded a minor degree only when he / she completes the requirements for the award of major degree stipulated in the respective programme.

21.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

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B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY
B.TECH. BIOTECHNOLOGY
CURRICULUM FRAMEWORK, REGULATIONS 2021
(Choice Based Credit System)

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BSC	PHD 1181	Applied Physics *	3	0	2	4
2.	BSC	CHD 1181	Engineering Materials and Applications *	3	0	2	4
3.	BSC	MAD 1182	Biomathematics	3	1	0	4
4.	ESC	GED 1101	Engineering Graphics	2	0	2	3
5.	ESC	GED 1102	Engineering Design	2	0	0	2
6.	ESC	GED 1103	Manufacturing Practices Laboratory	0	0	2	1
7.	ESC	GED 1104	Programming for Problem Solving **	1	0	2	2
			Credits				**20 #**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC	END 1281	English for Engineers	3	0	0	3
2.	PCC	BTD 1201	Basics of Genetics	3	0	0	3
3.	PCC	BTD 1202	Cell and Molecular Biology	3	0	2	4
4.	PCC	BTD 1203	Microbiology	3	0	2	4
5.	PCC	BTD 1204	Yoga and alternative medicine **	0	0	2	1
6.	ESC	GED 1203	Basic Electrical Engineering *	3	0	2	4
7.	MC	GED 1206	Environmental Sciences	2	0	0	2
			Credits				**21**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC		Humanities Elective I	3	0	0	3
2.	PCC	BTD 2101	Biophysics	3	0	0	4
3.	PCC	BTD 2102	Biochemistry *	3	0	2	4
4.	PCC	BTD 2103	Fundamentals of Chemical Engineering *	3	0	2	4
5.	PCC	BTD 2104	Analytical Techniques *	3	0	2	4
6.	PCC	BTD 2105	Technical Seminar **	0	0	2	2
7.	HSC	GED 2101	Essential Skills and Aptitude for Engineers**	0	0	2	1
			Credits				**22**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	BTD 2201	Plant and Animal Biotechnology *	3	0	2	4
2.	PCC	BTD 2202	Green Biotechnology and Pollution Abetment	2	0	0	2
3.	PCC	BTD 2203	Immunotechnology *	3	0	2	4
4.	PCC	BTD 2204	Recombinant DNA Technology	3	0	0	3
5.	PCC	BTD 2205	Bioinformatics and Chemoinformatics *	3	0	2	4
6.	PEC		Professional Elective-I	3	0	0	3
7.	PCC	BTD 2205	Project Based Learning and Comprehensive viva voice **	0	0	2	1
8.	HSC	GED 2201	Workplace Skills and Aptitude for Engineers**	0	0	2	1
9.	MC	GED 2202	Indian Constitution and Human Rights	2	0	0	0
			Credits				**22**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PCC	BTD 3101	Good Manufacturing and Laboratory Practice	2	1	0	3
2.	PCC	BTD 3102	Bioprocess Engineering *	3	0	2	4
3.	PCC	BTD 3103	Enzyme Technology *	3	0	2	4
4.	PCC		Professional Elective-II	3	0	0	3
5.	PCC		Professional Elective-III	3	0	0	3
6.	BSC	MAD 3182	Biostatistics	3	1	0	4
8.	HSC	GED 3101	Communication Skills for Career Success**	0	0	2	1
9.	PROJ	BTD 3105	Internship I ##	0	0	0	1
			Credits				**23**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	HSC	MSD 3281	Entrepreneurship	3	0	0	3
2.	HSC		Humanities Elective II	2	0	0	2
3.	OEC		Open Elective I	3	0	0	3
4.	PCC	BTD 3201	Nanobiotechnology	3	0	0	3
5.	PCC	BTD 3202	Food Biotechnology	3	0	2	4
6.	PCC	BTD 3203	Fermentation Technology and Bioreactor Design	3	0	2	4
7.	PEC		Professional Elective - IV	3	0	0	3
8.	PEC		Professional Elective - V	3	0	0	3
9.	HSC	GED 3201	Reasoning and Aptitude for Engineers**	0	0	2	1
			Credits				**26**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	OEC		Open Elective II				3
2.	OEC		Open Elective III				3
3.	PCC	BTD 4101	Data Analysis and Simulations	2	1	0	3
4.	PEC		Professional Elective - VI				3
5.	PEC		Professional Elective - VII				3
6.	PEC		Professional Elective - VIII				3
7.	PEC		Professional Elective - IX				3
8.	PROJ	BTD 4102	Internship II [###]				1
9.	PROJ	BTD 4103	Project Phase - I***				1
10.	HSC	GED 3202	Employability Skills [$]	0	0	2	1

		Credits	**24**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PROJ	BTD 4201	Project work				9

		Credits	**9**

Overall Total Credits – 166

* Laboratory Integrated Theory course

** Laboratory Course

*** Project Phase I, evaluation and grades will be given in the same semester

\# Three Week Orientation Programme – Mandatory Non-Credit Course

\#\# 15 days of Industrial training during the summer vacation of second year. The credit will be awarded in the 5th Semester.

\#\#\# 15 days of Industrial training during the summer vacation of third year. The credit will be awarded in the 7th Semester.

$ Not a Mandatory Course - The student will take up this course during the Summer Holidays of III year as a comprehension of Soft Skills courses offered from semester III to VI. Upon successful completion, the course will be mentioned in grade sheet of VII semester.

LIST OF PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
			Semester IV				
1.	PE	BTDX 01	Structural Biology	3	0	0	3
2.	PE	BTDX 02	Bio-Organic Chemistry	3	0	0	3
3.	PE	BTDX 03	Big Data Analytics	2	1	0	3
4.	PE	BTDX 04	Medical Biotechnology	3	0	0	3
			Semester V				
1.	PE	BTDX 11	Cancer Biology	2	1	0	3
2.	PE	BTDX 12	Genome Editing	1	1	2	3
3.	PE	BTDX 13	Biosimilars Technology	1	1	2	3
4.	PE	BTDX 14	Machine Learning	1	1	2	3
5.	PE	BTDX 15	Developmental Biology	3	0	0	3
6.	PE	BTDX 16	Tissue Engineering	1	1	2	3
7.	PE	BTDX 17	Drug Design and Development	2	1	0	3
8.	PE	BTDX 18	Biosafety and Bioethics	2	1	0	3
			Semester VI				
1.	PE	BTDX 31	Intellectual Property Rights	2	1	0	3
2.	PE	BTDX 32	Pharmaceutical Biotechnology	2	1	0	3
3.	PE	BTDX 33	Molecular and Cellular Diagnostics	2	1	0	3
4.	PE	BTDX 34	Molecular Pathology	2	1	0	3
5.	PE	BTDX 35	Artificial Intelligence for Biotechnology	3	0	0	3
6.	PE	BTDX 36	Waste Management and Upcycling	1	1	2	3
7.	PE	BTDX 37	Stem-Cell Technology	1	1	2	3
8.	PE	BTDX 38	Gene Expression and Transgenics	1	1	2	3

Semester VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	BTDX 60	Rational Drug Discovery	1	1	2	3
2.	PE	BTDX 61	State-of-the-art Imaging	1	1	2	3
3.	PE	BTDX 62	Precision Medicine and Wellness	1	1	2	3
4.	PE	BTDX 63	Industrial Biotechnology	2	1	0	0
5.	PE	BTDX 64	Bio separation Technology	2	1	0	3
6.	PE	BTDX 65	Proteomics and Genomics	2	1	0	3
7.	PE	BTDX 66	Biomedical Instrumentation	2	1	0	3
8.	PE	BTDX 67	Medical Biotechnology	2	1	0	3
9.	PE	BTDX 68	Material science	2	1	0	3
10.	PE	BTDX 69	Biomedical Engineering	2	1	0	3
11.	PE	BTDX 70	Healthcare Biotechnology	2	1	0	3
12.	PE	BTDX 71	Molecular Farming	2	1	0	3
13.	PE	BTDX 72	Transport Phenomena in Bioprocess	2	1	0	3
14.	PE	BTDX 73	Vaccine Technology	3	0	0	3
15.	PE	BTDX 74	Drug Formulation and Drug Delivery	3	0	0	3
16.	PE	BTDX 75	Regulatory Affairs for Biotechnology	3	0	0	3

HUMANITIES ELECTIVES – III Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	SSDX 01	Engineering Economics and Management	3	0	0	3
2	SSDX 02	Sociology of Science and Technology	3	0	0	3
3	SSDX 03	Industrial Economics and Management	3	0	0	3
4	SSDX 04	Dynamics of Indian Social Structure	3	0	0	3

HUMANITIES ELECTIVES – VI Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1	SSDX 11	Economics of Sustainable Development	2	0	0	2
2	SSDX 12	Sociology of Industrial Relations.	2	0	0	2
3	SSDX 13	Professional Ethics and Human Values	2	0	0	2
4	SSDX 14	Gender, Technology and Development	2	0	0	2

OPEN / GENERAL ELECTIVE COURSES FOR B.TECH. PROGRAMMES R 2021 - VI SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C	Offering Department
1	GEDX201	Application of Fluid Mechanics in Everyday Life	3	0	0	3	Aero
2	GEDX 202	Basics of Management and Organizational Behaviour	3	0	0	3	CSB
3	GEDX 203	Big data Analytics	3	0	0	3	CA
4	GEDX 204	Biology for Engineers	3	0	0	3	SLS
5	GEDX 205	Consumer Electronics	3	0	0	3	ECE
6	GEDX 206	Creative Writing	2	1	0	3	English
7	GEDX 207	Cyber Forensics	3	0	0	3	CSE

8	GEDX 208	Cyber Security	3	0	0	3	IT
9	GEDX 209	Disaster Management	3	0	0	3	Civil
10	GEDX 210	English for Competitive Examination	2	1	0	3	English
11	GEDX 211	Enterprise Risk Management	3	0	0	3	CSB
12	GEDX 212	Fundamentals of Project Management	3	0	0	3	CSB
13	GEDX 213	Industrial Robotics	2	0	2	3	Mech.
14	GEDX 214	Internet of Things and its Applications	3	0	0	3	ECE
15	GEDX 215	Introduction to Health Care Analytics	3	0	0	3	CA
16	GEDX 216	IPR and Patent Laws	3	0	0	3	CSB
17	GEDX 217	Logistics and Supply Chain Management	3	0	0	3	CSB
18	GEDX 218	Nano Materials and Technology	2	0	2	3	Physics / Chemistry
19	GEDX 219	Numerical Computational Tools for Engineers	2	0	2	3	EIE
20	GEDX 220	Optimization Techniques	3	0	0	3	EEE
21	GEDX 221	Polymers for Emerging Technologies	3	0	0	3	Polymer
22	GEDX 222	Programming Language Principles	3	0	0	3	CSE
23	GEDX 223	Public Speaking and Rhetoric	2	1	0	3	English
24	GEDX 224	Python Programming	2	0	2	3	IT
25	GEDX 225	R Programming	3	0	0	3	CA
26	GEDX 226	Smart Sensors for Healthcare Applications	3	0	0	3	EIE
27	GEDX 227	Total Quality Management	3	0	0	3	Mech.
28	GEDX 228	Value Education	3	0	0	3	Commerce
29	GEDX 229	Waste Water Management	3	0	0	3	Civil
30	GEDX 230	Web Application Development	3	0	0	3	CA

OPEN / GENERAL ELECTIVE COURSES FOR
B.TECH. PROGRAMMES R 2021 - VII SEMESTER

Sl. No.	Course Code	Course Title	L	T	P	C	Offering Department
1	GEDX 101	Advanced Entrepreneurship	3	0	0	3	CSB
2	GEDX 102	Artificial Intelligence and Machine Learning Applications	3	0	0	3	CSE
3	GEDX 103	Automotive Technology	3	0	0	3	Automobile
4	GEDX 104	Behavioural Psychology	3	0	0	3	SSSH
5	GEDX 105	Building Repair Solutions	3	0	0	3	Civil
6	GEDX 106	Cloud Services and Management	3	0	0	3	CA
7	GEDX 107	Cost Management for Engineers	3	0	0	3	Commerce
8	GEDX 108	Cyber Law and Ethics	3	0	0	3	CSL
9	GEDX 109	Data Analytics and Visualization	3	0	0	3	CA
10	GEDX 110	Deep learning Essentials	3	0	0	3	CSE
11	GEDX 111	Drone Technologies	2	0	2	3	Aero
12	GEDX 112	Electric Vehicle	3	0	0	3	EEE
13	GEDX 113	Emerging Technologies in mobile networks	3	0	0	3	ECE
14	GEDX 114	Fundamentals of Data Science and Machine Learning	3	0	0	3	IT
15	GEDX 115	Genetic Engineering	3	0	0	3	SLS
16	GEDX 116	Green Design and Sustainability	3	0	0	3	Civil
17	GEDX 117	Image Processing and its Applications	3	0	0	3	ECE
18	GEDX 118	Industrial Automation and control	3	0	0	3	EIE
19	GEDX 119	Industrial Safety	3	0	0	3	Mech.
20	GEDX 120	Industry 4.0	3	0	0	3	Mech.
21	GEDX 121	Introduction to Artificial Intelligence	3	0	0	3	IT

22	GEDX 122	Introduction to Artificial Intelligence and Evolutionary Computing	3	0	0	3	EEE
23	GEDX 123	Motor Vehicle Act and Loss Assessment	3	0	0	3	Automobile
24	GEDX 124	National Service Scheme	3	0	0	3	SSSH
25	GEDX 125	National Cadet Corps	3	0	0	3	SSSH
26	GEDX 126	Personal Finance and Investment	3	0	0	3	Commerce
27	GEDX 127	Soft Computing Techniques	3	0	0	3	CSE
28	GEDX 128	Value Analysis and Engineering	3	0	0	3	Mech.
29	GEDX 129	Vehicle Maintenance	3	0	0	3	Automobile

SEMESTER I

PHD 1181	**APPLIED PHYSICS**	L	T	P	C
SDG: 4		3	0	2	4

COURSE OBJECTIVES:

COB1: To make the students in understanding the importance of mechanics and properties of matter.

COB2: To classify the different types of crystal structures and study their defects.

COB3: To correlate the quantum mechanics principles and its impact in its application.

COB4: To introduce the basics of oscillations, optics and lasers.

COB5: To analyze the acoustics of buildings and applications of ultrasonics

MODULE I   MECHANICS AND PROPERTIES OF MATTER   9

Moment of inertia (M.I.) - Radius of gyration - Theorems of M .I - M.I of circular disc, solid cylinder , hollow cylinder , solid sphere and hollow sphere - Elasticity – Stress-strain diagram – Factors affecting elasticity – Poisson's ratio - Twisting couple on a wire – Shaft – Torsion pendulum – Bending moment - Depression on a cantilever – Young's modulus by cantilever – Uniform and non-uniform bending – I Shape Girders-Viscosity.

MODULE II   CRYSTAL PHYSICS   9

Miller Indices-Interplanar distance-closely packed crystal structures and Diamond structures –Reciprocal Lattice -Defects in crystals: voids – Line defects - Edge and screw dislocations - Surface Defects - Crystal Growth Techniques - Bridgman method – Czochralski method (qualitative)-Polymorphism and allotropy in crystals.

MODULE III   QUANTUM MECHANICS   9

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –– Dual nature of matter – de-Broglie wavelength - Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Quantum computing.

MODULE IV   OSCILLATIONS, OPTICS AND LASERS   9

Simple harmonic motion - resonance - waves on a string - standing waves - traveling waves - Energy transfer of a wave - Anti-reflection coating -Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet-Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: Nd:YAG laser –CO_2 laser and semiconductor laser - Applications : Laser Materials Processing - Holography.

MODULE V   ACOUSTICS & ULTRASONICS   9

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine's formula for reverberation time - Absorption coefficient and its measurement - Factors affecting the architectural acoustics and their remedy-Sound absorbing materials - Introduction to Ultrasonics - Properties - Production methods – MagnetostrictionOscillator method-Piezoelectric Oscillator method – Detection of Ultrasonics –Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow - Ultrasonic Flaw detector.

PRACTICALS

List of Experiments

1. Determination of rigidity modulus of the given wire using Torsional pendulum.
2. Determination of young's modulus of the beam by uniform / non-uniform bending method.
3. Determination of young's modulus of the beam by cantilever method.
4. Determination of coefficient of viscosity of low viscous liquid by Poiseuille's flow.
5. Determination of coefficient of viscosity of high viscous liquid by Stoke's method.
6. To determine the frequency of an electrically maintained tuning fork using a vibration generator. (Melde's experiment)
7. Determination of thickness of a thin wire / sheet using Air Wedge method.
8. Determination of wavelength of laser light using semiconductor laser diffraction.
9. Determination of angle of divergence of a laser beam using

semiconductor diode laser and He-Ne laser.

10. Determination of particle size of lycopodium powder using semiconductor laser.

11. Determination of velocity of sound in solids using Kundt's tube method.

12. Determination of velocity of ultrasonic waves in the liquid using ultrasonic interferometer.

L – 45; P – 30; Total Hours – 75

TEXTBOOKS:

1. P K. Palanisamy, Engineering Physics Vol I and II Scitech Publications (India) Pvt Ltd, 2018.
2. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.

REFERENCES:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education, 2017.
2. Brij Lal and N. Subramanyam, Properties of Matter, S.Chand& Co, 2003.
3. P K. Palanisamy, Engineering Physics Vol I and II Scitech Publications (India) Pvt Ltd, 2018.
4. Serway R.A. and Jewett, J.W., Physics for Scientists and Engineers with Modern Physics, Brooks/cole Publishing Co., 2010.
5. Tipler P.A. and Mosca, G.P., Physics for Scientists and Engineers with Modern Physics, W.H. Freeman, 2007.
6. Markert J.T., Ohanian. H. and Ohanian, M., Physics for Engineers and Scientists, W.W. Norton & Co., 2007.

COURSE OUTCOMES:

CO1: Grasp the importance of mechanics andthe principles of elastic behaviour of materials & apply them toanalyze the various substances based on elasticity.

CO2: Get acquainted with the topics concerning types, defects in crystalstructures, methods of preparation and apply the same to categorize differentcrystal systems in real time

CO3: Comprehend the importance &principles of quantum mechanics andutilize ideas to understand working of modern devices and its variants.

CO4: Know the basics of oscillations, optics and lasers and their applications.

CO5: Assimilate the ideas of acoustical requirements of buildings, understand principles of ultrasonics and add values to their usefulness in acoustical design of halls and their applications.

Board of Studies (BoS) :

BOS of Physics was held on 21.6.21

Academic Council:

17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	H	M	L	L	M	M	M	L	L	L	M	M	-	-	-
CO2	H	M	M	L	L	M	L	L	L	L	L	M	-	-	-
CO3	H	M	M	L	L	L	L	L	L	L	L	M	-	-	-
CO4	H	M	M	L	M	M	M	L	L	L	M	M	-	-	-
CO5	H	M	M	L	M	M	M	L	L	L	M	M	-	-	-

Note: L- Low Correlation   M -Medium Correlation   H -High Correlation

SDG 4: Ensuring inclusive and equitable quality education for all persons and promote lifelong learning opportunities.

Statement: The modules and topics mentioned in this course are designed to ensure all inclusive and thorough education with equity to all persons and always promote learning opportunities.

CHD1181	ENGINEERING MATERIALS AND APPLICATIONS	L	T	P	C
SDG: 9		3	0	2	4

COURSE OBJECTIVES:

To make the students conversant with

COB1: preparation, properties and applications of various polymers and composites

COB2: synthesis, properties, and applications of nanomaterials

COB3: the basic concepts and different types of catalysts involved in catalytic processes.

COB4: basic principles and its applications of certain spectroscopic techniques towards characterization of chemical compounds and concepts of photochemical processes involved in photochemical reactions.

COB5: different types of sensors and its applications.

MODULE I   POLYMER AND COMPOSITES   9

Introduction – classification: source, heat, composition and structure- glass transition temperature – synthesis, properties and applications of polycarbonate, polyurethane, teflon, ABS, kevlar, bakelite, epoxy resin, acrylic polymers (PAN) - biopolymers : importance and applications of biodegradable polymers (PLA, PHBV).

Composites- Introduction - properties and applications: fibre-reinforced plastics (glass, carbon, and aramid), ceramic matrix composites (CMC) –- bio-composites.

MODULE II   NANOCHEMISTRY   9

Introduction – classification based on dimension with examples – properties of nanomaterials (surface to volume ratio and size quantisation effect) - synthesis of nanomaterials (Top-down and Bottom-up)– role of capping & reducing agents - CVD (CNT), laser ablation (Ag, Ag_2O), electrodeposition (semiconductor materials), precipitation (Ag, Au), thermolysis: solvothermal (CuO, CeO_2) and hydrothermal (TiO_2, ZnO, carbon dots), microwave method (metal oxide), bio-nanomaterials - biogenic method (synthesis of Ag, Au by plants extracts, bacteria, fungi)

MODULE III   CATALYSIS   9

Types of catalysis – Criteria for catalysts - catalysis by transition metal ions and their complexes-   solid catalyst - metal oxides and zeolites - shape selective catalysts- mechanism of catalytic action- CO oxidation, NOx and

SOx reduction – Enzyme catalysis-Mechanism of enzyme action-electrocatalysis -green catalyst.

MODULE IV   PHOTOCHEMISTRY AND SPECTROSCOPY   9
Laws of photochemistry – Quantum yield -– Jablonski diagram - photophysical processes - photosensitisation – Quenching– chemiluminescence – bioluminescence

Atomic and molecular spectrum – absorption and emission spectrum - Beer Lambert's law – problems and applications – principles and applications: colorimetry, UV -vis spectroscopy (Chromophore- auxochrome, red and blue shift), atomic absorption spectroscopy, IR spectroscopy (fingerprint region, functional group interpretation)

MODULE V   SENSORS   9
Sensors – types: bio and toxic chemicals sensors- principle, working and applications of Electrochemical sensors: MEMS and NEMS, - Biosensors-construction, working and classification, Advantages - Biochips - touch sensor (oxi and gluco meter) - Advanced sensors: Smoke and gas sensors, humidity sensors, temperature sensor and alcohol sensor.

PRACTICALS
List of Experiments
1. Preparation of polymers – phenol-HCHO, urea-HCHO, polylactic acid, epoxy resin
2. Determination of molecular weight and degree of polymerization using Oswald'sviscometer.
3. Synthesis of nano-ZnO and CuO by precipitation
4. Demonstration of Laser ablation techniques for nanomaterials.
5. Electrochemical synthesis of graphene oxide
6. One-pot synthesis using green catalyst.
7. Green synthesis: Photocatalytic reactions, solvent - free organic reaction - Aldol; green oxidation, green reduction.
8. Diels - Alder reaction in eucalyptus oil (green process).
9. Spectrophotometer iron estimation.(Beer Lambert's law) determination of Fe^{3+}
10. FT-IR spectral characterisation (functional group interpretation)

L –45; P –30; Total Hours –75

TEXT BOOKS:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2016.
2. G.A. Ozin and A.C. Arsenault, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, Thomas Graham House, Cambridge,2012.
3. B. Viswanathan, S. Sivasanker and A.V. Ramaswamy (Editors), Catalysis: Principles and Applications, Narosa Publishing House, 2002.
4. Gadi Rothenberg, Catalysis: Concepts and Green Applications, WILEY-VCH
5. Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, Principles of molecular photochemistry: An introduction, University Science Books, Sausalito, CA, 2009.
6. John Vetelino, AravindReghu , Introduction to Sensors By · 2017.

REFERENCES:

1. Jhon S. Wilson, Sensor Technology Handbook, Elsevier 2005.

COURSE OUTCOMES:

The students will be able to

CO1: enumerate and compare the preparation, properties and applications of various types of polymers and composites.

CO2: synthesize different type of nanomaterials on a commercial scale based on its size and applications.

CO3: apply the concepts of spectroscopic techniques towards spectral interpretation for identification of compounds and explain various photochemical processes in photochemical reactions.

CO4: Impart types, characteristics, and applications of different types of catalyst.

CO5: categorize the sensors and its applications to real time situation.

Board of Studies (BoS):
11ᵗʰBoS of Chemistry held on 17.06.2021

Academic Council:
17ᵗʰ AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	M	-	-	-	-	-	-	-	-
CO4	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	M	-	-	-	-	-	-	-	-	-	-	-

Note: L- Low Correlation   M -Medium Correlation   H -High Correlation

SDG 9: To support scientific & technology development and innovation of materials and electronic devices

Introduction of basics on various materials and electronic devices towards innovation on new technology.

MAD 1182   **BIOMATHEMATICS**   **L   T   P   C**

SDG: 4   **3   1   0   4**

COURSE OBJECTIVES:

COB1: To develop the skills in the areas of Biotechnology necessary to become a successful biologist

COB2: To serve as basic tools for specialized studies in biological fields

COB3: To facilitate the students to apply basic mathematical tools to solve biological problems

COB4: To familiarize problem solving techniques using Numerical methods

COB5: To demonstrate the students with mathematical modeling in biological models

MODULE I   MATRICES   9+3

Characteristic Equation – Eigen values and Eigen vectors- Properties of Eigen values and Eigen vectors - Cayley -Hamilton Theorem (without proof) - Orthogonal transformation of a symmetric matrix to diagonal form.

MODULE II   CALCULUS   9+3

Derivatives – Partial Derivatives – Optima of two variables – Multiple Integral – Cartesian and Polar Coordinates – Integration using Partial Fraction Method.

MODULE III   ORDINARY DIFFERENTIAL EQUATIONS   9+3

Variable Separable – Homogeneous and Nonhomogeneous of first degree - Second order linear differential equation with constant coefficients, variable coefficients (Legendre and Cauchy).

MODULE IV   NUMERICAL METHODS   9+3

Solution of Linear and Nonlinear Equations: Newton Raphson, Fixed Point Iteration Method - Solution of Simultaneous Equation: Gauss Jordan, Gauss Elimination Method –Numerical Integration: Trapezoidal, Simpson's Rule

MODULE V   APPLICATIONS IN BIOLOGY   9+3

Role of Pattern in Biology - Reaction Differential Relation - Microbial Population Models – Mathematical Models.

L –45; T-15; Total Hours – 75

TEXT BOOKS:
1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 43rd edition, New Delhi, 2012.
2. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2010.
3. John W. Cell , "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943
4. Grewal, B.S., "Numerical methods in Engineering and Science", 7th edition, Khanna Publishers, 2007

REFERENCES:
1. Veerarajan.T., "Engineering Mathematics" (5th edition), Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011
3. Kreyszig,E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2001.
4. Kapur, J.N., "Mathematical Models in biology and medicine", New Age International Pvt. Ltd., Newyork 2008.

COURSE OUTCOMES:

At the end of the course students will be able to

CO1:understand the matrix techniques and compute Eigenvalues and Eigenvectors of a given matrix.

CO2:differentiate more than one variable and integrate multiple integrals

CO3:solve differential equations with constant and variable coefficients

CO4:find numerical Solution of transcendental and algebraic equations.

CO5: formulate mathematical models for biological problems and solve them

Board of Studies (BoS):   **Academic Council:**
12th BOS of Mathematics and AS   17th AC held on 15.07.2021
department held 23.06.2021

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

SDG 4: Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning of various mathematical tools like Matrices, Calculus and Numerical methods will lead to knowledge of applications in biological fields

GED 1101 **ENGINEERING GRAPHICS** L T P C

SDG: 9 2 0 2 3

COURSE OBJECTIVES:

COB1: To introduce the basic concepts of engineering drawing, and familiarize with conic sections, special curves and orthographic projection of points and straight lines

COB2: To get practical exposure on projection of planes and solids

COB3: To be familiar with sectioning of solids, and development of surfaces

COB4: To conversant with 3D isometric projection, and perspective projection of simple solids

COB5: To introduce computerized drafting using CADD for drawing the orthographic views of simple solids

MODULE I	BASICS, ENGINEERING CURVES AND ORTHOGRAPHIC PROJECTION OF POINTS AND STRAIGHT LINES	L:7 P:7

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola. Special curves: cycloid, epicycloid, hypocycloid, and involutes.

Orthographic projection – first angle, second angle, third angle and fourth angle projections. Orthographic projection of points in all quadrants. Projection of straight lines in first quadrant – true length and true inclinations – traces of straight line.

MODULE II	PROJECTION OF PLANES AND SOLIDS	L:7 P:7

Projection of plane lamina in first quadrant and its traces

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, and cylinder – change of position method

MODULE III	SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	L:5 P:5

Section of solids: prism, pyramid, cone, and cylinder– sectional view – true shape of section- cutting simple position solids - plane inclined to one reference plane only.

Development of surface of truncated solids: prism, pyramid, cone and cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE IV   THREE DIMENSIONAL PROJECTIONS   L:4
                                                P:4

Isometric projection: Isometric scale – isometric axes- Isometric projection and view of prism, pyramid, cylinder, cone and frustums.
Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid by Visual ray method.

MODULE V   ORTHOGRAPHIC PROJECTION USING CADD   L:7
                                                      P:7

Introduction to CADD - Basic commands for sketching - Editing sketches - creating texts and tables - Basic dimensioning and editing dimensions - Sketching orthographic views of simple solids and machine parts as per first angle projection - Plotting drawings.

L – 30; P – 30; Total Hours – 60

TEXT BOOKS:
1. N.D. Bhatt, "Engineering Drawing",Charotar Publishing house, 53rd Edtion, 2014.
2. Venugopal. K, and V. Prabhu Raja, "Engineering Graphics", New Age International (P) Ltd., Publication, Chennai, Edition 15, 2017.

REFERENCES:
1. K.V. Natarajan, "A text book of Engineering Graphics", Dhanalakshmi publishers, Chennai, 31st Edition, 2018.
2. Agrawal B. & Agrawal C. M., "Engineering Graphics", TMH Publication, 2012.
3. Jeyapoovan, T., "Engineering Graphics using AutoCAD", Vikas Publishing House Pvt. Ltd., New Delhi, 2015.
4. AutoCAD Software Theory and User Manuals
5. Engineering graphics You tube Lecture videos link: https://www.youtube.com/user/BSAUNIV/videos

COURSE OUTCOMES:
After completion of the course, students should be able to
CO1: identify the specifications and standards of technical drawing and draw conic sections, special curves and orthographic projection of points and straight lines
CO2: apply the concept of orthographic projection to draw the orthographic views of plane figures and simple solids

CO3:draw the sections of solids and development of solid surfaces

CO4:apply the concept of isometric and perspective projection to draw the 3-D views of simple solids

CO5:draw the orthographic views of simple objects using drafting software

Board of Studies (BoS):   **Academic Council:**

18thBoS of MECH held on 21.06.2021   17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO2	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO3	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO4	M	L	L	-	-	-	-	-	-	L	-	-	-	-
CO5	M	L	L	-	M	-	-	-	-	L	-	-	-	-

Note:L- Low Correlation   M - Medium Correlation   H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The various industrial standards of technical drawing and the application of orthographic projections to draw simple solids helps to innovate a new design for sustainable industrialization

| GED 1102 | **ENGINEERING DESIGN** | L | T | P | C |
| SDG:9 | | **2** | **0** | **0** | **2** |

COURSE OBJECTIVES:

COB1: To learn the basic concepts of design in engineering

COB2: To study the basic design thinking principles in problem solving

COB3: To encourage the students to develop a prototype using design concepts

COB4: To introduce the role of innovation in engineering

MODULE I   INTRODUCTION TO DESIGN   08

Introduction to Engineering design – Design thinking – Problem identification - Design of Product, Process, System and Software – Case studies on Product, Process, Systems and Software design.

MODULE II   DESIGN THINKING PROCESS   08

Empathy – Ideate - Need analysis - Voice of customers - product specification - concept generation - Bench marking - Quality function deployment - Concept evaluation - Case studies

MODULE III   PROTOTYPE DESIGN   07

Product form and function – High level design – Design detailing - Sketch models – Prototypes - 3D printing - Case studies.

MODULE IV   INNOVATION   07

Creativity and innovation – Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – Intellectual property rights - case studies on innovative products.

L – 30; Total Hours – 30

TEXT BOOKS:

1. Clive L. Dym, Patrick Little, and Elizabeth J. Orwin, "Engineering Design: A Project Based Introduction", 4th Edition, Wiley, 2014.

2. Eppinger, S. and Ulrich, K., "Product design and development", McGraw-Hill Higher Education, 2015.

REFERENCES:

1. Nigel Cross, "Design Thinking", Berg Publishers, 2011.

2. Tom Kelley, "The Art of Innovation", Profile Books Ltd, London, 2016.
3. Tim Brown, "Change by Design", HarperCollins e-books, 2009.
4. Cliff Matthews, "Case Studies in Engineering Design", John Wiley & Sons Pvt. Ltd, New York, 1998.

COURSE OUTCOMES:
After completion of the course, students should be able to
CO1:explain the basic concepts of design in engineering products / process / Service
CO2:analyse the problems and perform design thinking process
CO3:correlate the basic principles of design thinking to solve engineering problems and develop prototypes
CO4:apply innovative approaches to engineering problems and provide design solutions

Board of Studies (BoS):
18th BoS of MECH held on 21.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	H	-	-	-	-	-	-	-	-	-	-	-	-
CO3	H	-	H	-	M	-	-	-	-	L	-	L	-	-
CO4	-	-	M	-	-	-	-	-	-	L	-	L	-	-

Note: L- Low Correlation   M - Medium Correlation   H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The holistic understanding of basic knowledge in Engineering design and its process in the development of prototypes results in satisfying industrial challenges.

| GED 1103 | **MANUFACTURING PRACTICES** | L | T | P | C |
| SDG: 9 | **LABORATORY** | 0 | 0 | 2 | 1 |

COURSE OBJECTIVES:

COB1: To learn the basics of pipe connections used in household and industrial systems

COB2: To educate the usage of welding equipment's and machining methods

COB3: To impart knowledge onsandmould preparation for simple components

COB4: To explorevarious tools, instruments and methods used in electrical wiring

COB5: To impart knowledge onDesign, assembly and testing of electronic circuits

PRACTICALS

List of Experiments:

CIVIL ENGINEERING PRACTICE:

1. Study of plumbing in general household and industrial systems: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
2. Making a small window frame with Lap and Mortise & Tenon Joints by sawing planing and cutting.
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE:

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints using Arc Welding - Gas cutting (Demo)
2. Machining of a component using simple turning and drilling practices.
3. Foundry operations such as sand mold preparation for simple component.
4. Plastic Component Manufacturing (Demo on Injection / Blow moulding)

ELECTRICAL ENGINEERING PRACTICE:

1. Comparison of incandescent, fluorescent, CFL and LED lamps.
2. Domestic, staircase and go down wiring.
3. Measurement of earth resistance.
4. Study of protection devices (small relay, fuse, MCB, HRC, MCCB, ECCB).
5. Familiarization of household electrical gadgets (Iron Box, Wet Grinder).

6. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE:

1. Identifications and symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Design and testing of electronic circuits using active and passive electronic components

P – 30; Total Hours – 30

TEXT BOOK:

1. S.Gowri and T.Jeyapoovan, "Engineering Practices Lab Manual – Civil, Mechanical, Electrical, Electronics included", Vikas Publishing, 5th Edition, 2019.

REFERENCES:

1. SubhransuSekhar Dash &K.Vijayakumar, "Electrical Engineering Practice Lab Manual", Vijay Nicole Imprints Private Ltd., First Edition, 2013.
2. Raghbir Singh Khandpur, "Printed Circuit Boards: Design, Fabrication, and Assembly", Tata McGraw-Hill Education, 2005.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: demonstrate Plumbing requirements of domestic buildings.

CO2: use welding equipment's to join the structures and to carry out machining operations

CO3: perform the task of making sand mould for simple components

CO4: execute simple electrical wiring and comprehend the construction and working of household appliances.

CO5: assemble and test simple electronic circuits used in day-to-day life

Board of Studies (BoS):   **Academic Council:**
18thBoS of MECH held on 21.06.2021   17th AC held on 15.07.2021

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	L	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: L- Low Correlation   M -Medium Correlation   H -High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

The holistic understanding of welding, moulding, machining, wiring, and electronic circuit increases the access of small-scale industrial and other enterprises in developing countries.

GED 1104

SDG: 8

PROGRAMMING FOR PROBLEM SOLVING

L	T	P	C
1	0	2	2

COURSE OBJECTIVES:

COB1: To explore the hardware and software components of the computer

COB2: To learn the structured and procedural programming concepts using C.

COB3: To study the constructs of decision making in branching and iteration statements

COB4: To learn Functions for effective reusability and readability of the code.

COB5: To understand pointer and file operation concepts.

MODULE I   INTRODUCTION TO C PROGRAMMING   05

Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, system software, compilers, creating, compiling and executing a program, Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming - Structure of C - C Tokens – Data Types – Declaration of Variables and Storage class – Operators – Expressions - Type Conversion.

MODULE II   DECISION MAKING AND ARRAY   05

Decision Making and Branching: Simple if Statements, The if..else statements, Nesting of if..else statements, else…if Ladder, switch Statements, goto Statements, Looping: while, do…while, for Statements, Array: One-Dimensional, Two-Dimensional and Multi-Dimensional operations.

MODULE III   USER-DEFINED FUNCTIONS AND FILE   05
OPERATIONS

Definition of Functions - Function Types – Nesting of Functions – Recursion – Structures and Unions – Pointers - File handing operations.

L – 15; P – 30; Total Hours – 45

PRACTICALS
LIST OF PROGRAMS IN C:

1. Computer organization –Hardware in a typical computer Identification – Booting error messages and what it means
2. Structure of a basic program - Hello world program
3. Data types and Type conversions
4. Input / Output: Formatted functions – Unformatted functions – Library functions

5. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators

6. Conditional Statements: If – if else- nested if else- goto- switch case – nested switch case

7. Iteration Statements: for loops – nested for loops – while loop – do-while loop – break and continue statement

8. I/O operations of one- and two-dimensional arrays

9. Bubble Sort and Linear Search using arrays.

10. Functions and its types, Recursion Function

11. Pointers File Operations

TEXT BOOKS:

1. Richard L. Stegman, "Focus on Fundamentals of Programming with C", Ninth Edition, ISBN -170077395X, 9781700773951, 2019.

2. E.Balagurusamy, "Programming in ANSI C", McGraw Hill Education, Eighth Edition, ISBN-13: 978-93-5316-513-0, ISBN-10: 93-5316-513-X, 2019.

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.

2. Ashok N Kamthane, "Computer Programming", Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012.

3. Paul J. Deitel, Deitel& Associates, "C How to Program", Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012.

COURSE OUTCOMES:

Students who complete this course will be able to

CO1:identify the hardware components and describe the software components of computer.

CO2:bring out the importance of structural and procedural programming

CO3:write C coding using conditional and iteration statements

CO4:develop programs using Functions, Pointers and Files

CO5:implement program to build a real time application.

Board of Studies (BoS):
18thBoS of CSE held on 26.07.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	M	L	H	-	L	-	-	M	-	-	-	-	-
CO2	H	M	M	-	-	H	M	-	M	-	-	-	-	-
CO3	H	M	H	-	-	H	-	-	H	-	-	-	-	-
CO4	H	H	H	H	M	H	-	-	H	-	-	-	-	-
CO5	H	H	H	H	H	H	H	H	H	L	H	H	-	-

Note: L- Low Correlation   M -Medium Correlation   H -High Correlation

SDG 8: Promote sustained, inclusive, and sustainable economic growth, full and productive employment and decent work for all

Statement: The students can have productive employment and decent work by learning this computer fundamentals and programming course.

SEMESTER II

END 1181	**ENGLISH FOR ENGINEERS**	L	T	P	C
SDG: 4		3	0	0	3

COURSE OBJECTIVES:

COB1: To train students to use appropriate vocabulary in academic and technical contexts

COB2: To facilitate students to speak effectively while exchanging ideas and making presentations

COB3: To develop students' listening skill for comprehending and analysing information

COB4: To develop their reading skill through sub skills like skimming, scanning and critical reading of a text

COB5: To sharpen their academic writing skills

COB6: To expose them to the correct usage of language and help them to apply that knowledge appropriately

MODULE I   HUMAN RESOURCES   10

L: Listening to short texts – short formal & informal conversations.

S: Introducing one self – exchanging personal info.

R: Process of reading purposes, Reading comprehension, improving comprehension skills, Reading activities – short comprehension passages, practice in skimming & scanning.

W: Scientific & Technical Writing, Editing skills, Activities – completing sentences, developing hints - Paragraph Writing

Voc. development: Prefixes, Suffixes

Lang. development: Articles, Countable and Uncountable nouns, Present tense, Wh– Questions, Yes or No questions.

MODULE II   TRANSPORT   10

L: Listening to long scientific talks

S: Sharing personal information – greeting, leave taking.

R: Comprehension passages with multiple choice questions / Wh–questions/ openended questions - Reading longer technical texts & completing exercises based on them.

W: Use of reference words & discourse markers on a text, jumbled sentences, describing a process – flow chart, use of sequence words.

Voc. development: Guessing meanings of words in context, vocabulary used

in formal letters, e-mails & reports.

Lang. development: Preposition of Time, Place & Date, Past tense, Conjunctions, Impersonal passive voice, Question tags, Numerical Adjectives.

MODULE III   ENERGY   9

L:Listening to talk on the topic & completing tasks.

S: Asking about routine actions & expressing opinions.

R: Locating Specific Information

W: Letter seeking permission for Industrial Visit / symposium – Letter of invitation

Voc. development: Sequence words, misspelt words.

Lang. development: Adverbs, Degrees of comparison, Future tense, Homophones

MODULE IV   OUR LIVING ENVIRONMENT   8

L: Listening to scientific texts & making notes – Effective ways of making notes.

S: Speaking about one's friend.

R: Reading texts & magazines for detailed comprehension. (Students can be asked to read any book of their choice to encourage reading habit)

W: Argumentative writing.

Voc. Development: Synonyms, antonyms, phrasal verbs.

Lang. development: If clauses, Subject - Verb Agreement

MODULE V   TECHNOLOGY   8

L: Listening to talks (General & Scientific).

S: Short group conversations.

R: Reading and understanding technical articles, Short narratives & articles from Newspaper including conversations.

W: Short essays, Dialogue writing.

Voc. Development: Idioms & Phrases.

Lang. development: Modal verbs.

L - 45; Total Hours- 45

TEXT BOOKS:

1. Board of Editors. Using English A Coursebook for Undergraduate Engineers and Technologists. Orient BlackSwan Limited, Hyderabad: 2015

2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES:

1. Perry, Carol Rosenblum(2011). The Fine Art of Technical Writing, Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan G. andPrakash, C.L.N. (2007). A course in Communication Skills, Cambridge Univesity Press, India.
3. Sen, Leena(2004). Communication Skills, Prentice Hall, New Delhi.
4. Matt Firth, Chris Sowton et.al (2012). Academic English An Integrated Skills Course for EAP, Cambridge University Press, Cambridge.
5. Bailey,Stephen2011. Academic Writing: A practical guide for students, New York, Rutledge.
6. Redston, Chris&Gillies (2005). Cunningham Face2Face (Pre-intermediate Student's Book&Workbook) Cambridge University Press, New Delhi.
7. Dutt P. Kiranmai and RajeevanGeeta (2013). Basic Communication Skills, Foundation Books.

COURSE OUTCOMES:

CO1: Read articles of a general kind in magazines and newspapers

CO2:Participate effectively in conversations, introduce themselves and their friends and express opinions in English

CO3: Comprehend conversations and short talks delivered in English

CO4: Write short essays of a general kind and letters and emails in English

CO5: Express through speaking and writing using appropriate vocabulary and grammar

Board of Studies (BoS):	**Academic Council:**
13[th]BoS of Department of English held on 17.6.2021	17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO 12
CO1	-	-	-	-	-	-	-	-	-	M	-	-
CO2	-	-	-	-	-	-	-	-	-	H	-	-
CO3	-	-	-	-	-	-	-	-	-	M	-	-
CO4	-	-	-	-	-	-	-	-	-	H	-	-
CO5	-	-	-	-	-	-	-	-	-	M	-	-

Note:L- Low Correlation   M -Medium Correlation   H -High Correlation

SDG 4: Give Quality Education to all the Engineers

Statement: In future, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship.

BTD 1201 **BASICS OF GENETICS**   L   T   P   C
SDG: 3
                                        3   0   0   3

COURSE OBJECTIVES:

COB1: Introduction to the subject and few fundamental works on genetics

COB2: Interactions and structural organization of genes and chromosome

COB3: Significance of mutation and repetitive sequences

COB4: Genetic linkage analysis, sex determination and mapping techniques

COB5: Population genetics and evolutionary genetics

MODULE I **INTRODUCTION TO GENETICS** **12**

Historical developments in the field of genetics; various organisms suitable for genetic experimentation and their genetic significance; Mendelian genetics: Mendel's experimental design, monohybrid, di-hybrid crosses, Law of segregation & Principle of independent assortment; test cross and back cross, chromosomal theory of inheritance.

MODULE II **ALLELIC INTERACTIONS** **12**

Concept of dominance, recessive, incomplete dominance, co-dominance, semi-dominance, pleiotropy, multiple allele, pseudo-allele, essential and lethal genes, penetrance and expressivity.

MODULE III **CHROMOSOME AND GENOMIC ORGANIZATION** **12**

Structure and characteristics of bacterial and eukaryotic chromosome, chromosome morphology, concept of euchromatin and heterochromatin. Packaging of DNA molecule into chromosomes, chromosome banding pattern, karyotype, giant chromosomes, one gene one polypeptide hypothesis, concept of cistron, exons, introns, genetic code, gene function.

MODULE IV **SEX DETERMINATION AND SEX LINKAGE** **12**

Mechanisms of sex determination, Environmental factors and sex determination, sex differentiation, Barr bodies, dosage compensation, genetic balance theory, Fragile-X-syndrome and chromosome, sex influenced dominance, sex limited gene expression, sex linked inheritance. Genetic linkage, crossing over and chromosome mapping: Linkage and Recombination of genes in a chromosome crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Crossing over at four strand stage, Multiple crossing-over Genetic mapping.

MODULE V   EXTRA CHROMOSOMAL INHERITANCE   12

Rules of extra nuclear inheritance, maternal effects, maternal inheritance, cytoplasmic inheritance, organelle heredity, genomic imprinting. Evolution and population genetics: In breeding and out breeding, Hardy Weinberg law (prediction, derivation), allelic and genotype frequencies, changes in allelic frequencies, systems of mating, evolutionary genetics, natural selection.

L – 45; Total Hours – 45

TEXT BOOKS:

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings.
4. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings. 5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

COURSE OUTCOMES:

CO1: basic concept of genetics and fundamental work of Mendel

CO2: how variation in traits appear and basic and higher order structural organization of gene

CO3: the importance of repetitive sequence, mutation, and mechanistic detail of gene expression

CO4: mechanism of sex determination and chromosome mapping and linkage analysis

CO5: basic mechanism of inheritance, evolution, and population genetics

Board of Studies (BoS):
8th BoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	H	M	H	M	L	L	-	L	-	L	-	M
CO2	H	M	H	M	L	L	-	L	-	L	-	M
CO3	H	M	H	M	L	L	-	L	-	L	-	M
CO4	H	M	H	M	L	L	-	L	-	L	-	M
CO5	H	M	H	M	L	L	-	L	-	L	-	M

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 3: Good Health and Well Being

Statement: Understanding of the fundamentals of Genetics of different live organisms can help in maintain systems to promote good health and well being.

BTD 1202   **CELL AND MOLECULAR BIOLOGY**   L   T   P   C

SDG: 3

                                                    3   0   2   4

COURSE OBJECTIVES:

COB1: To impart knowledge about different cell structures

COB2: To understand the concept of fertilization and embryogenesis

COB3: To understand the concept of organogenesis and morphogenesis

COB4: To study fertilization process in detail

COB5: To understand the different process using different model organisms

MODULE I   MICROSCOPY   8

Visualizing cells and tissues; Integrating cells into tissues (animals and plants); Structure of cell and cell organelles, Details of the cell cycle, cell division and regulation; Cell-Cell junctions; Mitosis and Meiosis.

MODULE II   GAMETOGENESIS-I   8

fertilization and embryogenesis, morphogen gradients, differentiation, asymmetric cell division, cell fate and lineage determination; Developmental embryonic stages, zygotic division, incomplete division and consequences; Ecto, meso and endodermal development, neural plate and tube formation; Early asymmetric division and generation of symmetry in developing embryo in animals and plants.

MODULE III   GAMETOGENESIS-II   8

organogenesis and morphogenesis, metamorphosis, animal life cycle, sex determination and role of apoptosis in organ development; Role of morphogens and their gradient in axis patterning and determination. Concept of anteroposterior, dorso-ventral, and medio-lateral axis formation. Stem cells, pluripotency, and iPS cells.

MODULE IV   FERTILIZATION   8

Introduction to plant fertilization, ovule and egg, and support cells; Root and shootdevelopment, seed formation (monocot/dicot) and germination; flowering andnonflowering plants; Cellular differentiation and senescence; Meristematic tissue, development of root and leaf and floral tissues.

MODULE V   MODEL ORGANISMS   8

Model organisms like Drosophila melangoster, C. elegans, G. gallus, Xenopus. Arabidoposis,etc.;

PRACTICALS

1. Understanding components of different kinds of microscopes.

2. Visualization of mitochondria, plastids, and other intracellular structures.

3. Study of the life cycle of *Drosophila melanogaster*.

4. Study of different stages of chick embryos.

5. In situ hybridization of *Drosophila* embryos to study the cellularization process.

6. Observation of developmental mutants in Drosophila and *C. elegans*

7. Study of mitosis in onion root tips

8. Totipotency: Analysis of Growth and Subculture

L – 45; P – 30; Total Hours – 75

TEXT BOOKS:

1. Molecular Biology of the Cell: Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walte; 6th edition New York: Garland Science; 2008.

2. Cell and Molecular Biology-Concepts and Experiments; Gerald Karp et al. John Wiley;8th edition; 2015.

3. Plant Development: The Cellular Basis (1990 edition) by R. F. Lyndon (PublisherSpringer)

4. Topics in Plant Physiology 3. Series editors M. Black and J. Chapman; Unwin Hyman Ltd, 1990.

5. Plant growth and Development: a molecular approach: DE. Fosket; Academic Press 1994.

6. Developmental Biology (12th Edition) by Michael J.F. Barresi and Scott F. Gilbert (Publisher- Sinauer Associates Inc; 2019)

COURSE OUTCOMES:

CO1: Define components of a cell

CO2: Understand cellular structure and functions

CO3: Understand the mechanisms of Cell cycle control and cell division

CO4: Understand the concept of fertilization in plants and relate with cell biology

CO5: Acquire the concept ofmodel organisms and usage in experiments

Board of Studies (BoS):   **Academic Council:**

8thBoS of SLS held on 5.07.2021   17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1	H	M	H	M	L	L	-	L	-	-	-	L
CO2	H	M	H	M	L	L	-	L	-	-	-	L
CO3	H	M	H	M	L	L	-	L	-	-	-	L
CO4	H	M	H	M	L	L	-	L	-	-	-	L
CO5	H	M	H	M	L	L	-	L	-	-	-	L

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 3: Good Health and Well Being

Statement: Understanding of the fundamentals of cell biology live organisms can help in maintain systems to promote good health and well being.

BTD 1203
SDG 3, 15

MICROBIOLOGY

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

COB1: Describe how microorganisms are used as model systems to study basic biology, genetics, metabolism, and ecology.

COB2: Identify ways microorganisms play an integral role in disease, and microbial and immunological methodologies are used in disease treatment and prevention.

COB3: To provide an introduction to the science of microbiology, particularly medical microbiology, to the student with both limited background in the biological sciences and limited interest in pursuing this field further.

COB4: To provide concepts of microbial metabolism, growth and control of microbes.

COB5: Describe the opportunity available in applied & industrial microbiology through the different application.

MODULE I   MICROBES AND FUNCTIONAL ANATOMY   8

Types of microorganisms. Brief history of microbiology. Microbes& human warfare. Microbes & human disease, Classification of microorganism and methods of classifying and identification of microorganism.Size, shape, and arrangement of bacterial cells. Structures external to cell wall, structures internal to cell wall.

**MODULE II   OBSERVING MICROORGANISMS THROUGH A   8
                   MICROSCOPE**

Types of Microscopies -Light Microscopy, Two-Photon Microscopy, Scanning Acoustic Microscopy, Electron Microscopy, Confocal Microscopy, Scanned-Probe Microscopy; Preparation of Specimens for Light Microscopy- Preparing Smears for Staining, Simple Stains, Differential Stains, Special Stains.

MODULE III   VIRUSES, VIROIDS AND PRIONS   8

General Characteristics of Viruses -Host Range, Viral Size; Viral Structure - Nucleic Acid, Capsid and Envelope, General Morphology, Isolation, Cultivation, and Identification of Viruses - Growing Bacteriophages in the Laboratory, Growing Animal Viruses in the Laboratory, Viral Identification; Viral Multiplication- Multiplication of Bacteriophages, Multiplication of Animal Viruses; Prions- Plant Viruses and Viroid.

MODULE IV   MICROBIAL METABOLISM, GROWTH AND   8
CONTROL

Microbial metabolism and Biochemical Tests and Bacterial Identification; Growth requirements, culture media, obtaining pure cultures and preservation of cultures, growth of bacterial cultures, Control of Microbial Growth, Action of microbial control agents, physical and chemical methods of microbial control.

MODULE V   APPLIEDINDUSTRIAL MICROBIOLOGY   8

Food Microbiology- Foods and Disease, Industrial Food Canning, Aseptic Packaging, Radiation and Industrial Food Preservation, High-Pressure Food Preservation, The Role of Microorganisms in Food Production; Industrial Microbiology Fermentation Technology, Industrial Products, Alternative Energy Sources Using Microorganisms, Biofuels, Industrial Microbiology and the Future.

PRACTICALS

1. Sterilization techniques
2. Media preparation (solid and liquid)
3. Isolation,enumeration, and purification of microbes from a given sample
4. Staining Techniques (Gram staining, spore staining)
5. Motility test by Hanging drop method
6. Biochemical Characterization of Bacteria Oxidation/Fermentation Test
7. Biochemical Characterization of Bacteria Catalase, Oxidase and Urease Tests
8. Biochemical Characterization of Bacteria- IMViC test
9. Biochemical Characterization of Bacteria- Hydrogen Sulfide Test
10. Biochemical Characterization of Bacteria - Nitrate Reduction Test.
11. Biochemical Characterization of Bacteria - Casein and Starch Hydrolysis
12. Antibiotic Assay - Antimicrobial Sensitivity Test (Disc Diffusion Method)
13. Growth Kinetics (Bacterial Growth Curve)
14. Isolation of antibiotics producing bacteria
15. Isolation and characterization of plant microbes

L – 45; P – 30; Total Hours – 75

TEXT BOOKS:

1. Microbiology: An Introduction: Tortora, Funke& Case. 7th edition, 2001
2. Microbiology: Davis, Dulbecco, Eisen and Ginsburg, 3rd Edition, 1980
3. Introduction to Microbiology: Ross, 2nd Edition, 1986

4. General Microbiology: Stainier, Adelberq and Ingraham, 4th Edition, 1979

5. Laboratory Exercises in Microbiology, Fifth Edition by Harley−Prescott, The McGraw−Hill Companies, 2002

6. Lab manual

COURSE OUTCOMES:

CO1: Demonstrate a broad understanding of the diversity and range of microorganisms, the interactions between humans and microorganisms, the role of microorganisms in industrial and environmental processes, and their role in the development of the techniques that underpin modern molecular biology

CO2: Demonstrate proficiency in a set of core microbiological and molecular biological technical methods, including both an understanding of the principles of the methods and their utilization in laboratory settings

CO3: Demonstrate familiarity with the risk assessment process, and use this information to operate safely in the laboratory environment

CO4: Collect, organize, analyze, evaluate and interpret experimental data using appropriate quantitative, technological and critical thinking skills

CO5: Critically evaluate relevant scientific data and literature and comprehend the nature and scope of the scientific literature in microbiology and related areas

Board of Studies (BoS):
8thBoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1	H	L	-	-	-	-	L	L	-	-	-	L
CO2	H	L	-	-	-	-	L	L	-	-	-	L
CO3	H	L	-	-	-	-	L	L	-	-	-	L
CO4	H	L	-	-	-	-	M	L	-	-	-	L
CO5	H	L	-	-	-	-	H	L	-	-	-	L

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 3: Good Health and Well Being
Statement: Understanding of the fundamentals of Microbiology live organisms can help in maintains systems to promote good health and well being.
SDG15: Life on Earth
Statement: Microbiology course gives knowledge about the living and non living and relation with all the levels of life in the earth.

BTD 1204	**YOGA AND ALTERNATIVE MEDICINE**	**L**	**T**	**P**	**C**
SDG: 3, 16		**0**	**0**	**2**	**1**

COURSE OBJECTIVES:

COB1: To make the students understand the importance of sound health and fitness principles as they relate to better health.

COB2: To expose the students to a variety of yogic activities aimed at stimulating their continued inquiry about Yoga, health and fitness.

COB3: To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize mental pressure.

COB4: To develop among students an appreciation of yoga activity as a lifetime pursuit and a means to better health.

COB5: To make the students understand the importance of sound health and fitness principles as they relate to better health.

PRACTICALS

1. Indtroction to Meaning & Importance of Yoga, ofElements of Yoga

2. Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas

3. Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana &Shashankasana)

4. Relaxation Techniques for improving concentration - Yog-nidra

5. Asanas as preventive measures.

6. Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.

7. Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana,

   Trikonasana, Ardh Matsyendrasana.

8. Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana,

   Bhujangasana.

9. Diabetes: Procedure, Benefits & contraindications for Bhujangasana,

   Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.

10. Asthema: Procedure, Benefits & contraindications for Sukhasana,

Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

P – 30; Total Hours –30

TEXT BOOKS:

Light on Yoga by B.K.S. Iyengar.Thorsons; 2/18/06 edition

COURSE OUTCOMES:

On successful completion of the course the students will be able to:

CO1: Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.

CO2: Learn breathing exercises and healthy fitness activities

CO3: Understand basic skills associated with yoga including strengthand flexibility, balance and coordination.

CO4: Perform yoga movements in various combination and forms, Identify opportunities for participation in yoga activities.

CO5: Improve personal fitness through participation in yogic activities and assess yoga activities in terms of fitness value.

Board of Studies (BoS):
8thBoS of SLS held on 5.07.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12
CO1	-	-	-	-	-	H	L	-	-	-	-	-
CO2	-	-	-	-	-	H	L	-	-	-	-	-
CO3	-	-	-	-	-	H	L	-	-	-	-	-
CO4	-	-	-	-	-	H	L	-	-	-	-	-
CO5	-	-	-	-	-	H	L	-	-	-	-	-

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 3: Good Health and Well Being
Statement: Understanding of the fundamentals of cell biology live organisms can help in maintain systems to promote good health and well being.
SDG16: Peace, Justice and Strong Institutions
Statement: This course provides information for maintance peace in self, body, surrounding, society and enivironment.

| GED 1203 | **BASIC ELECTRICAL ENGINEERING** | L | T | P | C |

SDG: 3, 5, 8, 11, 12   3   0   2   4

COURSE OBJECTIVES:

COB1: To make the students understand the basic calculations and measurements in DC circuits.

COB2: To provide the basic knowledge on AC circuit calculations and measurements.

COB3: To familiarize with working and characteristics of different DC machines.

COB4: To impart knowledge on the fundamentals of transformer and AC rotating machines.

COB5: To acquaint the students with different methods of electric power generation.

MODULE I   DC CIRCUITS & MEASUREMENTS   12

The concept of voltage and current-Electric circuit elements: R, L, C – Independent and dependent sources - Ohm's law- Kirchhoff's law- series and parallel resistive circuits – Voltage and current division – Star-delta transformation - Mesh and nodal analysis of resistive circuits – simple problems - Measurement ofvoltage, current and power in DC circuits.

MODULE II   AC CIRCUITS & MEASUREMENTS   18

Sinusoidal voltage - RMS, average, peak value, peak factor and form factor - single phase RL, RC and RLC circuits –phasor representation - complex power – power factor - simple problems - Resonance in RLC circuits – 3 phase balanced circuit calculations– star and delta connections - Principles of measurement of AC voltage, current, power and energy - Measurement of three phase power – Protection of AC circuits: Fuse and MCB

MODULE III   ELECTROMAGNETISM & DC MACHINES   16

Construction, principle of operation, basic equations, characteristics and applications of DC generators, DC motors, single phase transformers and three phase induction motors. Working principle of BLDC Motor and its applications in home appliances.
(Qualitativetreatment only).

MODULE IV   AC MACHINES   16

Introduction to semiconductors - Characteristics of PN Junction Diode – Zener Diode and its characteristics – SCR and its characteristics — Bipolar Junction Transistorand its characteristics – JFET & MOSFET – their characteristics. Applications: Transistor as Amplifier -Half wave and full wave rectifiers - Voltage Regulation – Regulator ICs.

MODULE V   ELECTRICAL POWER SOURCES   13

Introduction to Wind, Solar, Fuel cell, Tidal, Geo-thermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation.

PRACTICALS

List of Experiments

1. Verification of KCL and KVL (ii) Measurement of voltage, current and power in DC circuits.
2. (i) Resonance of RLC series circuit

   (ii) Measurement of voltage, current, power and power factor in single phase & three phase AC circuits.
3. (i) Magnetization characteristics of DC generator

   (ii) Load Characteristics of DC shunt motor,
4. Load characteristics of single-phase transformer and three-phase induction motor.
5. Site visit to any thermal / hydro / wind / solar power generating station.

L – 45; P – 30; Total Hours – 75

REFERENCES:

1. Edward Hughes, "Electrical and Electronics Technology", Pearson India, 12th Edition, 2016.
2. D P Kothari and I J Nagrath, "Basic Electrical Engineering", McGraw Hill Education, First Edition, 2017.
3. Cotton H, "Electrical Technology", CBS Publishers, 7th Edition, 2007.
4. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2015.
5. Hayt and Kimberly, "Engineering Circuit Analysis", Tata McGraw Hill, 2012
6. Kulshreshtha D.C., "Basic Electrical Engineering", Tata McGraw Hill, 2009.
7. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice

8. SahdevRitu, "Basic Electrical Engineering", Khanna Book Publishing Co., 2018.

COURSE OUTCOMES:

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

CO1: perform the basic calculations in DC circuits and measure the various quantities associated with DC circuits.

CO2: measure and compute the rms current and voltage, power, power factor and energy in AC circuits.

CO3: choose appropriate DC motor for specific applications based on the motor characteristics.

CO4: interpret the specifications of different AC machines used in industries.

CO5: explain the methods by which electrical energy can be generated.

Board of Studies (BoS):
15th meeting of BoS of EEE held on 25.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	H		H	L	M		M		L	L	M	L			
CO2	H		H	L	M		M		L	L	M	L			
CO3	H		H	L			M		L	L	M	L			
CO4	H		H	L			M		L	L	M	L			
CO5	H		H	L			M		L	L	M	L			

Note: L - Low Correlation   M - Medium Correlation   H - High Correlation

SDG 3: Good health and well being.

Statement: Understanding of the fundamentals of electrical and electronics systems can help in designing systems to promote good health and well being.

SDG 5: Gender equality

Statement: Acquiring the interdisciplinary knowledge help overcome the gender barriers in workplace.

SDG 8: Descent work and economic

Statement: The learners of this course can get descent work and earn financial benefits and they can work in interdisciplinary areas.

SDG 11: Sustainable cities and communities

Statement: Understanding the renewable energy sources helps in building sustainable cities and communities.

SDG 12: Responsible consumption and production.

Statement: Use of right and energy efficient electric and electronic components and devices results is reasonable consumption and production.

GED 1206   ENVIRONMENTAL SCIENCES   L   T   P   C
SDG: All   2   0   0   2

COURSE OBJECTIVES:
To make the student conversant with the
COB1: various natural resources, availability, utilisation and its current scenario.
COB2: diverse ecosystems and its function, importance of biodiversity, its values, threats and conservation.
COB3: types of pollutants and its impacts on the environment and the effects of natural disasters.
COB4: impacts of human population, human health, diseases and immunisation for a sustainable lifestyle.

MODULE I   NATURAL RESOURCES   8
Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems - (a) Land resources: Land degradation soil erosion and desertification - (b) Forest resources: Use and over-exploitation, deforestation (c) Water resources: Use and over-utilisation of surface and ground water, conflicts over water, dams: benefits and problems, effects on forest and tribal people - (d) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, mining (e) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture (f) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources.

MODULE II   ECOSYSTEMS AND BIODIVERSITY   8
Concept of an ecosystem - Food chains, food webs, Energy flow in the ecosystem - ecological pyramids - Ecological succession - Characteristic features, structure and function of (a) Terrestrial Ecosystems: Forest ecosystem, Grassland ecosystem, Desert ecosystem (b) Aquatic fresh water ecosystems: Ponds and lakes, rivers and streams (c) Aquatic salt water ecosystems: oceans and estuaries
Biodiversity and its conservation - Types: genetic, species and ecosystem diversity - Values of biodiversity - India as a mega-diversity nation - Invasive, endangered, endemic and extinct species - Hot sports of biodiversity and Red Data book - Threats to biodiversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

MODULE III ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT 8

Sources, cause, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear pollution (h) ill-effects of fireworks and upkeep of clean environment, types of fire and fire extinguishers- Solid waste Management: types, collection, processing and disposal of urban waste, industrial waste, e-waste and biomedical wastes - Disaster management: flood, drought, cyclone, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES 6

Human Population - Population growth, Population explosion, population pyramid among nations - Family Welfare Programme - Human Rights - Value Education - Environment and human health: air-borne, water borne, infectious diseases, contagious diseases and immunisation (all types of vaccines from birth), risks due to chemicals in food and water, endocrine disrupting chemicals, cancer and environment - Sustainable development - Resettlement and rehabilitation of people - Environment Legislative laws- Women and Child Welfare, Public awareness.

Case studies related to current situation.

L – 30; Total Hours –30

TEXT BOOKS:
1. Erach Bharucha, "Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education for University Grants Commission", Orient Blackswan Pvt. Ltd., Hyderabad, India, 2013.
2. Benny Joseph, "Environmental Studies", Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, "Environmental Science and Engineering", Sri Krishna Publications, Tamil Nadu, India, 2018.
4. Raman Sivakumar, "Introduction to Environmental Science and Engineering", McGraw Hill Education, India, 2009.
5. Venugopala Rao P, "Principles of Environmental Science and Engineering", Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., "Environmental Science and Engineering", New Age International Pvt. Ltd., New Delhi, India, 2009.

REFERENCES:
1. Masters G.M., "Introduction to Environmental Engineering and Science", Prentice Hall, New Delhi, 1997.

2. Henry J.G. and Heike G.W., "Environmental Science and Engineering", Prentice Hall International Inc., New Jersy, 1996.

3. Miller T.G. Jr., "Environmental Science", Wadsworth Publishing Co. Boston, USA, 2016.

4. "Waste to Resources: A Waste Management Handbook", The Energy and Resources Institute, 2014.

5. https://www.teriin.org/article/e-waste-management-india-challenges-and-opportunities.

6. https://green.harvard.edu/tools-resources/how/6-ways-minimize-your-e-waste.

7. https://www.aiims.edu/en/departments-and-centers/central-facilities/265-biomedical/7346-bio-medical-waste-management.html.

8. https://tspcb.cgg.gov.in/Shared%20Documents/Guidelines%20for%20Management%20of%20Healthcare%20Waste%20Waste%20Management%20Rules,%202016%20by%20Health%20Care%20Facilities.pdf.

COURSE OUTCOMES:

The student will be able to

CO1: analyse the current scenario of various natural resources and their depletion and suggest remedies to curb the exploitation.

CO2: identify food chains and web and its function in the environment, assess the impacts on the biodiversity and propose solutions to conserve it.

CO3: analyse the types and impacts of pollutants in the environment and propose suitable methods to alleviate the pollutants and the natural disasters.

CO4: assess on the impact of human population and the health related issues and immunisation practices and sustainable developments for a healthy life.

Board of Studies (BoS) :
11th BoS of Chem held on 17.06.2021

Academic Council:
17th AC held on 15.07.2021

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	-	L	M	-	-	L	M	-	-	-	-	-	-	-	-
CO2	-	-	-	M	H	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	M	M	-	-	L	-	-	-	-
CO4	-	-	-	-	-	M	M	M	-	-	-	L	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SDG All: No Poverty, Zero Hunger, Good Health and Well-Being, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable & Clean Energy, Decent Work and Economic Growth, Industry, Innovation & Infrastructure, Reduced Inequalities, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life on Land, Peace, Justice and Strong Institutions, Partnerships for the Goals.

Statement: This course discuss about the environment, all the natural resources available, sharing of resources, effective utilisation, effects of over utilisation, health and environmental issues pertained to that, global warming and related issues, climates, disasters, impact assessments, population, human rights, societal welfare, laws to conserve the environment and sustainability.