Prasad V. Potluri Siddhartha Institute of Technology (Autonomous)
Approved by AICTE and Affiliated to JNTUK
Accredited by NAAC : A+
All UG programs accredited by NBA, ISO 9001-2015
Certified Institute
Vijayawada, Andhra Pradesh, India.

ACADEMIC RULES & REGULATIONS (PVP19)

AND

FOUR YEAR B.TECH COURSE STRUCTURE AND SYLLABUS

DEPARTMENT OF CIVIL ENGINEERING

PREFACE

PVP Siddhartha Institute of technology, established in 1998, is one of the seventeen educational institutions sponsored and run by Siddhartha Academy of General & Technical Education. The 250 members of the Academy are a group of industrialists, educationists, auditors and philanthropists with vast experience in their respective fields and above all with an ardent desire to spread quality Education. All the academic organizations of Siddhartha Academy stand symbolic of the pragmatic vision of its founders. PVP Siddhartha Institute of Technology has the advantage of inheriting the higher academic standards. The college is approved by AICTE and is permanently affiliated to JNTUK. It is certified by ISO 9001-2015 for its quality standard. It is accredited by the National Board of Accreditation and NAAC with A^+ grade. Moreover, it is an Autonomous College.

The curriculum is revised continuously to address the challenges of industry and academia and to foster the global competencies among the students. The curriculum is revised two times since 2012. The present curriculum(PVP19) is designed incorporating the features such as outcome based approach, Choice Based Credit System, encouraging self-learning through MOOCs platforms i.e., Swayam, Courses Era, EDX, NPTEL, etc., Transformation of creative ideas into a prototype through project phase I & phase II, enhancing depth & breadth by introducing more number of programs, open & interdisciplinary electives in core and multi-disciplinary areas, offering courses by industry experts to improve Industry Institute Interaction in addition to internships at industry and introduction of wide range of value added courses beyond curriculum to choose according to their interest to enhance their skills and employability.

VISION OF THE INSTITUTE

To provide rich ambience for academic and professional excellence, research, employability skills, entrepreneurship and social responsibility.

MISSION OF THE INSTITUTE

To empower the students with technical knowledge, awareness of up- to-date technical trends, inclination for research in the areas of human needs, capacity building for employment/entrepreneurship, application of technology for societal needs.

VISION OF THE DEPARTMENT

The Department of Civil Engineering will provide quality education on par with the premier organizations of the country so that our students become leaders in education, industry and governance. Department strives to attain national recognition in research, teaching and professional service ensuring sustainability to various upcoming developments in the society at the regional and national scenario.

MISSION OF THEDEPARTMENT

- ➢ To provide state of art education in Civil Engineering with a well-balanced program of instruction and practical experience
- ➢ To impart managerial skills for construction and sustainable development for societal needs.
- ➢ To generate research opportunities that creates synergy among faculty, students, and practicing professionals.
- ➢ To contribute to the quality of life through innovation in the knowledge generation, sharing and its use.

PROGRAM EDUCATIONAL OBJECTIVES	
PEO	**STATEMENTS**
PEO I	The graduates will have analytical and experimental abilities and design capabilities in Civil Engineering career.
PEO II	The graduates will have good scientific and engineering domain to play an appropriate role in multidisciplinary professional activities with effective communicative skills to provide integrated and sustainable solutions for engineering problems.
PEO III	The graduates will have attitude for lifelong learning and pursue higher education and research. They will perform with engineering ethics and social responsibility in their professional career making use of state of art, modern tools and managerial skills.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
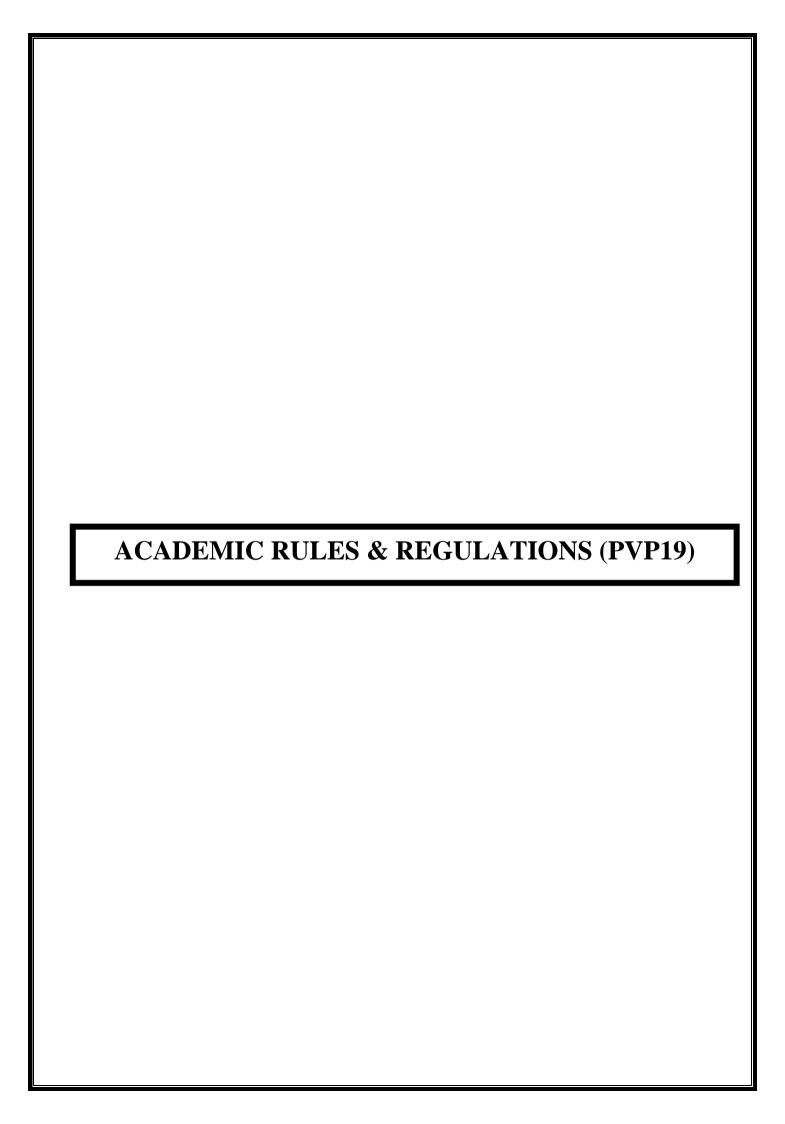
PROGRAM SPECIFIC OUTCOMES (PSOs)

1. **PSO1. UNDERSTANDING:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.

2. **PSO2.BROADNESS AND DIVERSITY:** Graduates will have a broad understanding of economic, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.

QUALITY POLICY

At PVPSIT, We commit ourselves to offer Quality professional education in engineering & Management by adhering to applicable statutory and regulatory requirements and through continuous improvement in the Quality of our services by,

- Regular upgradation of knowledge and skills of faculty
- Improving the teaching methods and strategies
- Providing state of art infrastructure
- Recruiting competent faculty and maintaining prescribed Teacher Student ratio
- Improving the employability of students
- Enhanced Collaboration with industry and institutions of National Repute

ACADEMIC RULES & REGULATIONS (PVP19)

1. SHORT TITLE AND COMMENCEMENT

a. The regulations listed under this head are common for all degree level undergraduate programmes (B.Tech.), offered by the college with effect from the academic year 2019-20 and they are called as "PVP19" regulations.

b. The regulations hereunder are subjected to amendments as may be made by the Academic Council of the college from time to time, keeping in view of the recommendations of the Board of Studies. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the programme, as may be decided by the Academic Council.

2. DEFINITIONS

a. "**Commission**" means University Grants Commission (UGC);

b. "**Council**" means All India Council for Technical Education (AICTE);

c. "**University**" means Jawaharlal Nehru Technological University Kakinada (JNTUK);

d. "**College**" means Prasad V Potluri Siddhartha Institute of Technology, Vijayawada;

e. An **Academic Programme** means any combination of courses and/or requirements leading to award of a degree.

f. "**Course**" means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.

g. "**Degree**" means an academic degree conferred by the university upon those who complete the undergraduate curriculum.

h. "**CBCS**" means Choice Based Credit System

i. "**MOOC**" means Massive Open Online Course

j. "**Regular Students**" means students enrolled into the four year programme in the first year.

k. "**Lateral Entry Students**" means students enrolled into the four year programme in the second year.

3. ACADEMICPROGRAMMES

3.1 Nomenclatureof Programmes

3.1.1 The nomenclature and its abbreviation given below, shall continueto be used for the Degree programmes under the University, as required by the Council and the Commission:

Bachelor of Technology (B.Tech.)

Besides, the name of specialization shall be indicated in brackets after the abbreviation, for example, engineering degree in Mechanical Engineering programme is abbreviated as B.Tech (Mechanical Engineering).

3.1.2 Bachelor of Technology(B.Tech.)degreeprogrammeisofferedin:

1. CivilEngineering(CE)
2. ComputerScienceandEngineering(CSE)
3. ElectronicsandCommunicationEngineering(ECE)
4. ElectricalandElectronicsEngineering(EEE)
5. InformationTechnology(IT)
6. MechanicalEngineering(ME)

4. DURATIONOFTHE PROGRAMMES

4.1 NormalDuration

4.1.1. The duration of an academic programme shall be four years consisting of eight semesters.

4.1.2. The duration of the programme for lateral entry students who are admitted in II year shall be three years that consists of six semesters.

4.2 MaximumDuration

4.2.1Themaximumperiodforwhichastudentcantaketocompletea full time academic programme shall be double the normal duration of the programme, i.e., for regular students eight years, for lateral entry students six years.

4.3 MinimumDurationofaSemester

Each semester consists of a minimum of 90 instruction days excluding examination days with about minimum 26 and maximum 35 contact hours per week.

5. ADMISSIONCRITERIA

The eligibility criteria for admission into UG Engineering programmes are as per the norms approved by Government of Andhra Pradesh from time to time.

The sanctioned seats in each programme in the college are classified into CATEGORY-A, and CATEGORY-B at I year level and onlyCATEGORY-A at Lateral Entry II year level.

ThepercentagesofCategory–A,Category-BandLateralEntrySeatsaredecided from time to time by the Government of Andhra Pradesh.

5.1 CATEGORY–A Seats

Category - A seats are filled as per the norms approved by the Government of Andhra Pradesh.

5.2 CATEGORY–B Seats

Category - B seatsare filled by the College asper the norms approved bythe Government of Andhra Pradesh.

5.3 CATEGORY-LateralEntrySeats

Lateralentrycandidatesshallbeadmittedintothe IIIsemesterdirectlyas per the norms approved by Government of Andhra Pradesh.

6. CREDITSYSTEMANDGRADEPOINTS

6.1 CreditDefinition

'Credit' means quantified and recognized learning. Credit is measured in terms of contact hours per week in a semester. Typically one credit is given to:

(a) Theory/Tutorialcourseconductedforonecontactperiod.

(b) Laboratorycourse conductedfortwo contact periods.

Each course is assigned a certain number of credits depending upon the number of contact hours (Lectures/Tutorials/Practical) per week.

The curriculum of the eight semesters B.Tech program is designed to have a total of 160 credits for the award of B.Tech degree.

For lateral entry students, the curriculum of six semesters B.Tech program is designed to have a total of 121.5 credits for the award of B.Tech degree.

6.2 SemesterCourseLoad

The average course load shall be fixed at 20 credits per semester with its minimum and maximum limits being set at 13 and 24.5 credits.

6.3   GradePointsandLetterGradeforaCourse

Thegradepointsandlettergradewillbeawardedtoeachcoursebasedon student's performance as per the grading system shown in the Table1.

Table1:GradingSystemforB.TechProgramme

Theory/Drawing %ofMarks	Laboratory/Project %ofMarks	Grade Points	Letter Grade
≥90%	≥90%	10	S
80 – 89%	80 – 89%	9	A
70 -79%	70 -79%	8	B
60 -69%	60 -69%	7	C
50 -59%	55 -59%	6	D
40 -49%	50 – 54%	5	E
<40%	<50%	0	F(FAIL)
ABSENT	ABSENT	0	AB

6.4 SemesterGradePointsAverage(SGPA)

Theperformanceofeach studentattheendoftheeach semesterisindicatedinterms of SGPA calculated as shown in equation (1).

$$SGPA = \frac{\square \ \square CR \square GP \square}{\square CR \square \text{forallcoursesofferedinthe semester} \square}$$

--(1)

WhereCR=Credits ofa course

GP=Gradepointsawardedforacourse

6.5 CumulativeGradePointAverage(CGPA)

The Cumulative Performance of each student at the end of each semester is indicated in terms of CGPA which is calculated as shown in equation (2).

$$CGPA = \frac{\sum CR \times GP}{\sum CR (for all courses offered upto th\ at semester/entire program)} \quad \text{-- (2)}$$

WhereCR =Credits ofa course

GP=Gradepointsawardedforacourse Percentage

equivalent of CGPA = (CGPA – 0.5) * 10

7. CURRICULUMFRAMEWORK

7.1 GeneralIssues

7.1.1 Curriculum framework is important in setting the right direction for a degree programme as it takes into account the type and quantum of knowledge necessary to be acquired by a student in order to qualifyfor the award of degree in his/her chosen branch or specialization.

7.1.2 Besides, this also helps in assigning the credits for each course, sequencing the courses semester-wise and finally arriving at the total number of courses to be studied and the total number of credits to be earned by a student in fulfilling the requirements for conferment of degree.

7.1.3 Eachtheorycourseshallconsist offiveunits.

7.2 CurriculumStructure

The curriculum is designed to facilitate CBCS and incorporates courses required to attain the expected knowledge, skills and attitude by the time of graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories (as described in 7.2.1 to7.2.6) to coverthe depth and breadth required for the programme and for the attainment of programme outcomes of the corresponding programme.

7.2.1 InstitutionalCore

Institutional Core consists of the courses required for all UG Engineering Programmes offered in this college. The courses offered under this category cover the required knowledge in the following areas:

(a) Basic Sciences:

Basic Science courses include Engineering Physics, Applied Physics, Engineering Physics Lab, Applied Physics Lab Engineering Chemistry,ChemistryofMaterials,EngineeringChemistryLab,

Chemistry of Materials Lab, Mathematics I (calculus and Algebra), EngineeringMathematics II (ODE,PDEandMultivariableCalculus), Engineering Mathematics III, Engineering Mathematics IV, Life Sciences for Engineers and Life Sciences for Engineers Lab.

(b) EngineeringSciences:

Engineering Science courses include Problem Solving and Programming, AI Tools, Internet of Things, Design Thinking & Product Innovation, Basic Electrical and Electronics Engineering, Engineering Graphics, Problem Solving & Programming Lab, Basic Electrical & Electronics Engineering Lab, AI Tools Lab, Internet of Things Lab, Design Thinking and Product Innovation Lab and Basic Workshop.

(c) HumanitiesandSocialSciences:

Humanities and Social Science Courses consist of Communicative English I, Communicative English II, HS-I (Engineering Economics & Management), HS-II (Organizational Behavior), Communicative English I Lab and Communicative English II Lab.

7.2.2 ElectiveCourses

Electivecoursesareofferedacrosstheprogrammestoenhancetheknowledge breadth and professional competency of the students.

Courses	BranchSpecific	Compulsory
Electivecourses	ProgramElectives	Supportive to the discipline courseswithexpandedscopeina chosen track of specialization or crosstrack courses
	InterdisciplinaryElectives	Interdisciplinary exposure & nurturethestudentinterestsin other department courses
	OpenElectives	Common to all disciplines that helpsgeneralinterestofastudent

Greater flexibility to choose variety of courses is provided through Massive Open Online Courses (MOOCs) during the period of study. Students without any backlog courses upto III semester are permitted to register for MOOCs from IV semester onwards upto a maximum of 15 credits from Program Elective/Interdisciplinary Elective/Open Elective Courses. However, the Departmental Committee (DC) has to approve the courses under MOOCs. The Departmental committee consists of Head of the Department, Program coordinator and Module Coordinator.

Students can register and complete the opted course in approved MOOCs platform on or before the last instruction day of IV/V/VI/VII semester. They have to submit the pass certificate before the last instruction day of that concerned semester.

7.2.3 ProgrammeCore

The Programme core consists of set of courses considered which are necessary for the students of the specific programme. The courses under this category satisfy the Programme Specific Criteria prescribed by the appropriate professional societies.

7.2.4 Project

Project Phase I & Project Phase II will be initiated in VII semester and completed before the end of VIII semester.

Project PhaseI can bedonebya groupofstudents, workingunderthe guidance of a faculty member and carrying out a detailed feasibility study, literaturesurveyandsubmitareportregarding work planfor the project phase II.

Project Phase II involves continuation of Project Phase I. The objective is to complete the work as per the prepared work plan and submit a detailed project report.

7.2.5 IndustryInteraction

ThestudentsmayregisterforeitherInternshiporIndustryofferedcourse during the summer break after VI semester to secure 2 credits.

Internship/Industryofferedcourses arepurelymeant forinternal Assessment which will be evaluated for 75 marks during the VII semester.

a) Internships

The students may undergo Internship for 3 to 6 weeks duration in the industry approved by respective head of the department at the end of VI semester.

b) Industryofferedcourses

The students can opt for the courses under this category that areoffered by the Industry experts whose minimum academicqualification is Bachelor of Engineering or equivalent.

7.2.6 MandatoryLearningCourses

According to the guidelines given by statutory bodies, Courses on Environmental Science, Constitution of India and Engineering Ethics shall be offered.

InductionprogramshallbeofferedinIsemesterforallthebranches.

NCC/NSS/NSO/YOGAshallbeofferedinI&IIsemesters.

Environmental Science and Constitution of India shall beoffered in III & IV semesters.

EngineeringEthicsshall beofferedinV/VIsemesters.

7.3 CourseNumberingScheme

TheCoursecodeconsistsofEight/Nine characters.ThefollowingisthestructureofthecourseCode (Figure1).

19	CS	1	2	0	3	A
Regulation	**CourseCategory**	**Kindofcourse**	**Semester**	**Type**	**Course Number**	**[Electivecode]**
Last two digits of Regulation offered (i.e. 19 for PVP19 regulations)	HS-HumanitiesandSocialSciences includingManagementcourses BS-BasicSciencecourses ES - Engineering Science MC - Mandatory Courses In case of Professional Core/ Professional Electivecoursesdepartmentcodeisplaced: CE-Civil Engineering CS-ComputerScience&Engineering EC - Electronics andCommunication Engineering EE-Electrical&ElectronicsEngineering IT - Information Technology ME-MechanicalEngineering	1. Institutional Core (i.e.HS,BS, ES, MC) 2. Inter Disciplinary Elective 3. ProgramCore 4. Program Elective 5. OpenElective	1- First 2- Second 3- Third 4- Fourth 5- Fifth 6- Sixth 7- Seventh 8- Eight	0- Theory 1-Theory studiedin MOOCS Mode 5- Practical 6- Project Work 7- Industrial Training/ Internship	i.e. Course sequence Numberinthat semester	Incase if the course is Elective then this fieldwillspecifythe elective code (i.e.A,B,C.)

Figure1:Coursenumberingscheme

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7.4 MediumofInstructionand Examination

ThemediumofinstructionandexaminationsshallbeEnglish.

7.5 Registration

Everystudenthastoregisterhimself/herselfforthecoursesineachsemester individually at the time as specified in academic calendar.

8. ChoiceBasedCreditSystem(CBCS)

Choice Based Credit System (CBCS) shall be introduced with effect from 2019-20 academic year, based on guidelines of the statutory bodies in order to promote:

- o   Activitybasedlearning
- o   Studentcenteredlearning
- o   Studentstochoosecoursesoftheirchoice
- o   Learningattheirownpace
- o   Interdisciplinarylearning

Flexibility is extended to the fast learning students to take the courses of higher semesters in advance as per their convenience to concentrate on their placement activity/ project work, etc., during the VII/VIII semesters.

8.1 CBCSCourseRegistrationPolicy

Fast learning students can register for additional courses from higher semesters by satisfying the pre-requisite course(s) to a maximum of 8 credits in each ofthe semesters from III semester onwards along with the regular semestercourses as prescribed. There is no minimum limit to the credits for taking additional courses.

EligibilityforchoosingCBCSflexibility:

- **Regular Students (4 Year duration),** entering the nth semester with no backlog courses up to $(n-1)^{th}$semester, are only eligible to opt for this flexibility.

- **Lateral entry students (3 year duration)** with 70% Marks in their Diploma are eligible to opt for this flexibility during III and IV Semesters. Those students entering into V/ VI /VII semester with no backlog courses up to $(n-1)^{th}$semester, are only eligible to opt for this flexibility

The list of additional courses offered in the even & odd semesters, registration dates will be notified by the respective departments well in advance.

Astudentcanwithdrawfromtherespectivecoursewithin15daysafterthe commencement of the course.

Thechoiceof utilizingthis flexibilityispurelyoptionalto the students.

A minimum number of students required to register for an additional course shall be twenty (20). In case, the registered strength for the additional course is less than twenty (20), the course may be offered on the recommendation of the Head of the Department and subsequent approval of the Principal.

8.2 ContinuousInternalEvaluation(CIE)forCBCSoptedCourses

Thecontact hours,continuous assessment pattern, eligibilitycriteriato writeend semester examinations and revaluation scheme for these additional courses will be as per the current academic regulations [PVP19].

8.3 EligibilitytoappearCBCSregisteredcoursesforSemesterEnd Examinations

The registered additional courses will be dealt separately as individualcoursesfor the calculation of attendance and continuous assessmentof marks for assessingthe eligibilitytowritetheendsemester examinationsforthesecourses.

The performance of the student in the registered additional courses will be separately mentioned in the semester end grade card and it will not be taken into account for the calculation of the SGPA for that semester.

The performance of the student in the registered additional courses will be taken into account in the corresponding semesters.

8.4 CBCSCourseDetention

8.4.1 In case, the student is detained for want of minimum specified attendance and continuous assessment marks criterion either in the regular semester or in the additional courses, he/she will forfeit the eligibility for registering additional courses from that semester onwards. However, the additional courses completed by the students in the earlier semesters will be valid and taken into consideration.

8.4.2 In case, the student is detained for want of minimum specifiedattendance and continuous assessment marks criterion in the regularsemester but meets minimum specified attendance and continuousassessment marks criterion in the registered additional courses, he/sheshall write the end semester examinations for these additional coursesalong with the regular students in the corresponding semester only.

8.4.3 In case, the student fails/is absent in the end semester examinations of the registered additional courses or in the regular semester courses in a particular semester, he will forfeit the eligibility for registering additional courses from that semester onwards. However, the additional courses completed by the students in the earlier semesters will be valid and taken into consideration. They can write the end semester examinations for additionalcoursesinwhichtheyfailed/wereabsent,alongwithregular

studentsinthecorrespondingsemesters only.

8.4.4 The criterion for the promotion to higher semesters will be as per PVP19 regulations, taking only the regular semester courses into consideration for the fast learners.

8.4.5 Additionalcourses,inwhichthefastlearningstudentfails,willnot be considered as backlogs for them.

8.4.6 Thefastlearningstudentsshallregisterforallthecoursesofaregular semester excluding the courses completed in the previous semesters.

8.4.7 The credits scored by students through CBCS subjects shall not be considered for credit promotion from II year to III year or from III year toIV year B.Tech.

8.4.8 Thestudent optingforthesaid flexibilitywill beconsidered forthe award ofthe division on par with other regular students.

8.4.9 The students who have earlier history of indulging in malpractices in semester end examinations are not eligible for opting CBCS

8.4.10 If the student fails to register for opted CBCS courses for semester end examination, he/she will forfeit the eligibility for registering additional courses from that semester onwards and marks secured through continuous assessment will not be considered.

8.4.11 Thechoiceof utilizingthisflexibilityis purelyoptionalto the students.

8.4.12 If a student fails/absent in aCBCS course, he/she is bound to appearin the same course when studied in regular semester.

9. EXAMINATIONS&SCHEMEOFEVALUATION

9.1 DescriptionofEvaluation

9.1.1 Continuous Internal Evaluation (CIE): The performance of the student in each course is evaluated by the faculty/course coordinator all through the semester; with mid-term tests (sessional-1and sessional-2), assignments, project reviews, viva-voce, laboratory assessment and other means covering the entire syllabus of the course.

9.1.2 Semester End Examination (SEE): It shall be conducted bychief controller of examinationsattheendofeachsemester,aspertheacademiccalendarand with a written examination for theory courses and practical/project examination with built-in oral part for laboratory/project.

9.2 ContinuousInternalEvaluation(CIE)

9.2.1 TheoryCourses

Eachcourseisevaluatedfor30marks (a+b+c)

a) Two assignment tests (Assignment Test-1 & Assignment Test-2) for 10 marks each will be conducted with1 hour duration. Assignment-1 shall be conducted from Unit-1 and Assignment-2 shall be conducted from Unit-4. Theassignmenttestmarksshallbeawardedtakingtheaverageoftwo

assignmenttests.

TheAssignmenttestshallbeheldinthezerohourand theclassworkwillbe conducted as usual in those days.

The Question bank with minimum number of 6 comprehensive questions from the concerned UNIT of the syllabus will be given to students at least a week in advance before the commencementof Assignment Test.

The question paper shall contain 2 comprehensive questions,each one is meant for 5 Marks. The student is required to answer all the questions.

b) Home assignment shall be conducted for 5 marks from Unit-3. The question bank with 10 to 15 comprehensive questions from unit-3 shall be given to students. Each student has to answer 3 questions from the question bank which will be assigned by the concerned faculty.

c) TwoMid-term(Sessional -1andSessional -2)examinations with15Marks each shall be conducted with **90 minutes** duration.

TheMid-termexaminationsshallbeheldinthezerohourandclasswork shall be conducted as usual in those days.

The Mid-term marks shall be awarded taking the average of two Mid-termexaminations.

Thequestionpapershallbegiveninthefollowingpattern:

PartA: Containstwoquestions,onefromeachunit.Thestudentshall answer all questions. Each question is for 2.5 marks.

Part B: Contains four questions. Two questions shall be given from each unitwithinternalchoice.Thestudentshallanswer1questionfrom each unit. Each question carries 5 marks.

Syllabus for CIE

NameoftheTest	Syllabus
AssignmentTest–1	UNIT–I
Sessional–1	UNIT-I&UNIT–II
HomeAssignment	UNIT–III
AssignmentTest–2	UNIT–IV
Sessional–2	UNIT–IV&UNIT–V

The questions shall be framed in Assignment tests and Sessional examinations in line with the Course Outcomes defined and cognitive levels.

9.2.2 MandatoryLearningCourses

Eachcourseisevaluatedfor100marks(a+b)

a) TwoMid-term(Sessional-1andSessional-2)examinationseachfor40 Marks shall be conducted with **90 minutes** duration.

The Mid-term examinations shall be held in the zero hour and the class work shall be conducted as usual in those days.

Thequestionpapershallbegiveninthefollowingpattern:

The question paper contains four questions. Two questions shall be given fromeachunitwithinternalchoice.Thestudentshallansweronequestion from each unit. Each question carries 20 marks.

b) Home assignment for 20 marks shall be conducted from Unit-3. The question bank with 10 to 15 comprehensive questions from unit-3 shall be given to students. Each student has to answer 4 questions from the question bank which will be assigned by the concerned faculty.

The Mid-term marks shall be awarded as sum of two Mid-termexaminations and home assignment.

Syllabusfor CIE

NameoftheTest	Syllabus
Sessional–1	UNIT–I&II
HomeAssignment	UNIT–III
Sessional–2	UNIT–IV&V

9.2.3 LaboratoryCourses

For Laboratory courses, there shall be continuous evaluation during the semester for 25 marks and semester end evaluation for 50 marks. The distribution of marks for continuous internal evaluation is given in the Table 2:

Table2:DistributionofMarks(CIE)

S.No.	Criterion	Marks
1	Dayto Daywork	10
2	Record	05
3	InternalExam	10

9.2.4 ProjectPhaseI

For Project Phase I, there shall be continuous internal evaluation during the semester for 100 marks. The continuous internal evaluation for the Project Phase I shall be on the basis of day to day assessment by theproject guide and two reviews conducted by the Project Review Committee (PRC). The PRC consists of Head of the Department, Programme Coordinator, Senior Faculty member of the department and Project guide. The distribution of continuous internal evaluation marks is given in the Table 3:

Table3:DistributionofMarks(CIE)

S.No.	Criterion	Marks
1	Dayto DayAssessment	40
2	TwoReviews	30+30

9.2.5 ProjectPhaseII

For Project Phase II, there shall be continuous internal evaluation during the semester for 100 marks and semester end evaluation for 100 marks. The continuous internal evaluation for the Project Phase II shall be on the basis of day to day assessment by the project guide and two reviews conducted by the Project Review Committee (PRC). The PRC consists of Head of theDepartment, Programme Coordinator,SeniorFacultymember of thedepartment and Project guide. The distribution of marks is given in the Table 4:

Table4:DistributionofMarks(CIE)

S.No.	Criterion	Marks
1	Dayto DayAssessment	40
2	TwoReviews	30+30

9.2.6 MOOCsCourses

Students who have qualified in the examination conducted by the MOOCs providers as specified in 7.2.2 are exempted from appearing in the continuous and semester end evaluations conducted by the institution.

In case, a student fails to complete the MOOCs course offered by MOOC's providers,he/shemaybeallowedtoregisteragainforthesamewithanyofthe

providers from the list provided by the department or the student may beallowed to register for the course as and when offered by the college as supplementary candidate.

Students Registered and cleared the opted courses in MOOC's are exempted from appearing Semester end examinations conducted by the Institute.

The Scheme of Evaluation for MOOCs courses shall be scaled to continuous internal evaluation as 30 marks and semester end examination as 70 marks.

9.3 SemesterEndExamination

9.3.1 TheoryCourses:70Marks

The Semester end examination shall be conducted with 3 hours duration at the end of the semester. The question paper shall be given in the following pattern:

a) **Part A:** Contains 5 questions of 2 marks each to test the knowledge level of the student. One question shall be given from each unit of the prescribed syllabus included in five units. The student shall answer all questions.

b) **Part B:** Contains 10 questions. Two questions from each unit shall be given with internal choice. Each question carries 12 marks. Each course shall consist of five units of syllabus. The student shall answer one question from each unit.
The questions shall be framed in line with the Course Outcomes defined and cognitive levels.

9.3.2 LaboratoryCourses:50marks

i. TheSemester end examination forlaboratorycourses shall be conducted with three hour duration at the end of semester for 50 marks as given below:

Table5:DistributionofMarks(SEE)

S.No.	Criterion	Marks
1	Procedure	10
2	Experiment/Programme Execution	20
3	Result	10
4	Viva-Voce	10

ii. Each Semester end Laboratory Examination shall be conducted by an External Examiner along with the Internal Examiner.

9.3.3 ProjectPhaseII:100marks

The semester end examination for project phase II shall be held for 100 marks by a committee consisting of an external examiner, Head of the Department, Programme coordinator and Project guide. The evaluation of the project work shall be conducted at the end of the VIII Semester.

The average of the marks awarded by the committee members shall be taken into consideration in case of variation among the members.

Theevaluationof100marksisdistributed asgiveninTable6:

Table6:DistributionofMarksinProjectPhase II

Sl.No.	Criterion	Marks
1	Report	40
2	Presentation	30
3	Viva–Voce	30

9.3.4 Internship/IndustryInteraction:75Marks

a) Internships:

The candidate shall submit the comprehensive report to thedepartment. The report will be evaluated for 75 marks by the Review Committee consisting of Head of the department, Programme Coordinator and Concerned Industry Representative/ Industry Institute Interaction Coordinator.

b) IndustryOfferedCourses:

The semester end examination for the courses under this category is evaluated for 75 marks and it shall be conducted and evaluated by the industry expert who has delivered the lecture or by the faculty nominated by the head of the department in consultation with the industry expert. The question paper pattern shall be decided by the industry expert at the beginning of the course and the same is to be approved by the Principal.

There will not be continuous internal evaluation for the courses under this category.

9.4 ConditionsforPassMarks

9.4.1 Acandidateshallbedeclaredtohavepassedinindividualtheory/drawing

courseifhe/shesecuresaminimumof40%aggregatemarks(Continuous Internal Evaluation & Semester End Examination marks put together), subject to a minimum of 35% marks in semester end examination.

9.4.2 A candidate shall be declared to have passed in individual laboratory course/project if he/she secures a minimum of 50% aggregate marks (Continuous Internal Evaluation &Semester End Examination marks put together), subject to a minimum of 40% marks in semester endexamination.

9.4.3 Mandatory Courses are assessed for PASS or FAIL only. No grade will be assignedtothesecourses. Ifacandidatesecuresmorethan40outof100marks, he / she will be declared PASS or else FAIL.

9.4.4 Mandatory courses NCC/NSS/NSO/YOGA are assessed for satisfactory or not satisfactoryonly.Nogradewillbeassigned.Acandidatehastoundergotwohours training per week in any one of the above in both I and IIsemesters.

9.4.4 Thestudenthastogetpassmarksinthefailedcoursebyappearingthe supplementaryexamination as per the requirement for the award of degree.

9.4.5 Thestudentshallearnassignedcreditsforthecourseonpassingacourseofa programme,.

9.5 Revaluation

9.5.1 ContinuousInternalEvaluation

The continuous Evaluation scripts shall be shown to the students before finalizing the marks. However, if the student has any concern, notaddressed before the finalization of marks, he/she may submit the application for revaluation to the concerned head of the department.

The Head of the Department may constitute a two member committee for re-evaluating the script. The evaluation of the committee is final and binding.

9.5.2 SemesterEndExamination

1. As per the notification issued by the Controller of Examinations, the students can submit the applications for revaluation, along with the requisitefeereceiptforrevaluationofhis/heranswerscript(s)oftheory course(s), if he/she is not satisfied with the marks obtained.

2. The Controller of Examinations shall arrange for re-evaluation of those answer script(s).

3. Anewexternalexaminer,otherthanthefirstexaminer,shallre- evaluate the answer script(s).

4   Revaluation marks will be taken into consideration only if the difference between the two valuations is more than or equal to 15%. Better marks between the two shall be taken into consideration. However, if the revaluation marks facilitates passing of the candidate, then the revaluation marks will be considered even if the difference of marks is less than 15%.

5   If the difference of marks between the two valuations is more than 20%, theanswerscriptwillbereferredtothirdvaluation.Theaverageofnearest two marks will be awarded.

9.6 Withholdingof Results

Ifthestudent has not paid thedues to thecollege, orifanycaseofmalpractice or indiscipline is pending against him, the result of the student will be kept as withheld and he/she will not be allowed to enter the next semester. His/her degree shall be considered as withheld in such cases.

10   CRITERIA TO ATTENDSEMESTER END EXAMINATIONAND PROMOTION TO HIGHER SEMESTER

10.1   Eligibility for SemesterEnd Examinations

10.1.1   Students shall put in a minimum average attendance of 75% in the courses from category 7.2.1 to 7.2.6 put together, computed by totaling the number of periods of lectures, tutorials, drawing, practical and project work as the case may be, held in every courseas the denominator and the total number of periods attended by the student in all the courses put together as the numerator, to be eligible to write semester end examinations.

10.1.2   Condonation of shortage in attendance may be recommended by respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance as calculated above and provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student.

10.1.3   Students, having more than 65% and less than 75% of attendance, shall have to pay requisite fee towards condonation.

10.2   ConditionsforPromotion

10.2.1   A student shall be eligible for promotion to next Semester ofB.Tech.programme,if he/shesatisfiesthe conditionsasstipulatedin Regulations **10.1.**

10.2.2   Further, a student shall be eligible for promotion to V / VIISemester ofB.Tech.programme,ifhe/shecompletestheacademic

requirementsof50%ofthecreditsuptoIV/VIsemesters.

10.2.3 Promotion to V Semester

For Four Year B.Tech Course candidates

Afour yearprogrammestudentshallbepromotedfrom IVsemestertoV semester only if he/she earns **50% credits** of the designed programme credits from I semester to IV semester.

10.2.4 PromotiontoVII Semester
i) ForFourYearB.TechCoursecandidates

A four year programme student shall be promoted from VI semesterto VII semester only if he/she earns 50% credits of the designed programme credits from I semester to VI semester.

ii) ForLateralEntrycandidates

A lateral entry student shall be promoted from VI semester to VII semester only if he/she earns 50% credits of the designed programme credits from III semester to VI semester.

10.2.5 ForDetainedStudents

a) Students who are already detained for want of credits shall bepromoted to **V Semester** if he/she fulfills the 50 % of the credit requirements from all the regular and supplementary examinationsheld upto IV Semester till the commencement of next academic year.

b) Students who are already detained for want of credits shall bepromoted to **VII Semester** if he/she fulfills the 50 % of the credit requirements from all the regular and supplementary examinationsheld upto VI Semester till the commencement of next academic year.

11. SUPPLEMENTARYEXAMINATIONS

11.1 General

SemesterendSupplementaryexaminationsshallbeconductedalong with regular semester end examinations.

11.2 AdvancedSupplementaryExams

Candidate(s), who fails in Theory or Laboratory courses of VIII semester, can appear for advanced supplementary examination conducted within one month after declaration of the revaluationresults.However,thosecandidateswhofailintheadvanced

supplementary examinations of VIII semester shall appear for subsequent examinations along with regular candidates conducted at the end of the respective academic year.

12. READMISSIONCRITERIA

Acandidate, whoisdetainedinasemester dueto lackofattendance/credits,has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling all the required norms stipulated by the college in addition to paying an administrative fee of **Rs. 1,000/-**

Rulesforcalculationofattendanceforreadmittedstudents

a) Number of classes conducted shall be counted from the commencement day of the semester concerned, irrespective of the date of payment of tuition fee.

b) They shall submit a written request to the principal of the college, along with a challan paid towards tuition and other fee, for readmission before the commencement of the classwork.

c) They can get the information regarding date of commencement of class work for each semester that will be made available in the college notice boards/website from time to time.

13. BREAKINSTUDY

Student, who discontinues the studies for valid reason permitted by the principal, shall get readmission into appropriate semester of B.Tech. programme after break-in study, with the prior permission of the Principal and following the transitory regulations applicable to such batch in which he/she joins. An administrative fee of **Rs**. 1**000/-**per each year of break in study, in addition to the prescribed tuition and special fee has to be paid by the candidate to condone his/her break in study.

14. TRANSITORYREGULATIONS

A candidate, who is detained or discontinued in a semester, on re-admission, the academic regulations under which he/she has originally admitted will continue to be applicable to him/her on re-admission.

15. ELIGIBILITYFORAWARDOFB.TECH.DEGREE

15.1 TheB.Tech.Degreeshallbeconferredonacandidatewho satisfiesthe following requirements.

15.1.1 ARegularstudent(fouryearprogramme)shallregisterandsecurehimself/her self for **160** Credits from the categories 7.2.1 to 7.2.6

15.1.2 A Lateral Entrystudent (three yearprogramme) shall registerand secure himself/herself for **121.5** credits from the categories 7.2.1 to7.2.6

15.2 Awardof Division

Thecriteriaforawardofdivision,aftersuccessfulcompletionof programmeis as shown in table 6

Table6:CriteriaforAwardof Division

CGPA	DIVISION
≥7.5	FirstClasswithdistinction*
≥6.5-<7.5	FirstClass
≥5.5-<6.5	SecondClass
≥5.0-<5.5	PassClass
<5.0	Fail

*Awarded onlyifall the courses prescribed are cleared in singleattempt within four years for regular candidates and three years for lateral entry candidates

* Detained and break-in study candidates are not eligible for the award of First Class with Distinction

* The cases of students who are absent for semester end examination only once in his/her duration of B.Tech. programme on valid medical grounds/humanitarian grounds shall also be considered for the award of First class with Distinction subject to the recommendations of the committee constituted by the Principal.

For the purpose of awarding First, Second and Pass Class CGPA obtained in the examinations appeared within the maximum period allowed for the completion of the programme shall be considered.

15.3 ConsolidatedGradeCard

A consolidated grade card containing credits & grades obtained by the students will be issued after successful completion of the four year B.TechProgramme.

16. CONDUCTANDDISCIPLINE

16.1 Studentsshallconductthemselveswithinandoutsidethepremisesofthe Institute in a manner befitting the students of our Institution.

16.2 AspertheorderofHonorableSupremeCourtofIndiaandAICTE guidelines,ragginginanyformisconsideredacriminaloffenceandis

banned.Ragging within or outside any educational institution is prohibited. Ragging means doing an act, that causes or is likely to cause insult or annoyance or fear of apprehension or threat or intimidation or outrage of modesty or injury to a student.Any form of ragging will be severely dealt with as per AP Prohibition of Ragging Act-1997 section-4.

Table–7:PunishmentsforRagging

Natureofragging	Punishment
Teasing,embarrassingand humiliating	Imprisonmentupto6monthsorfine upto Rs.1,000/- or both
Assaultingorusingcriminal forceorcriminalintimidation	Imprisonmentupto1yearorfine uptoRs.2,000/-orboth
Wrongfullyrestrainingor confiningor causinghurt	Imprisonmentupto2yearsorfine uptoRs.5,000/-orboth
Causing grievous hurt kidnapping or raping or committingunnaturaloffence	Imprisonmentupto5yearsandfine upto Rs.10,000/-
Causingdeath or abetting suicide	Imprisonmentupto10yearsandfine uptoRs.50,000/-

16.3 A student who is convicted of an offence and punished with imprisonment for a term of more than six months shall not be admitted into the institution.

16.4 Whenever any student complains of ragging to the head or manager of an educational institution, such head or manager should inquire into the complaint and if the complaint is prima-facie found true, should suspend the student or students complained against.

16.5 If the head or manager of an educational institution fails or neglects to take action in the manner specified in the Act, the person shall be deemed to have abetted the offence and shall be punished with the punishment provided for the offence.

16.6 If a student commits suicide due to or in consequence of ragging, the personwho commits such ragging shall be deemed to have abetted such suicide.

The following acts of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures.

i. Lack of courtesy and decorum; indecent behaviour anywhere within or outside the campus.

ii.   Possession,consumptionordistributionofalcoholicdrinksoranykindofnarcotics or hallucinogenic drugs.

Thefollowingactivitiesarenotallowedwithinthecampus:

➢ Mutilationorunauthorizedpossessionoflibrarybooks.

➢ Noisyandunseemlybehaviour,disturbingstudiesoffellow students.

➢ Hacking computer systems (such as entering into other person's areas without prior permission, manipulation and/or damage of computer hardware and software or any other cybercrime etc.)

➢ Useofmobilephones.

➢ Plagiarismofanynature.

➢ Anyotheractof grossindisciplineasdecidedbytheInstitutefromtimetotime.

➢ Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute/ hostel, debarment from a examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handingover the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

➢ For an offence committed in (i) a hostel, (ii) a department or in a class room and (iii) elsewhere, the Chief Warden, the Head of the Department and the Principal, respectively, shall have the authority to reprimand or impose fine.

➢ Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Principal for taking appropriate action.

➢ Unauthorizedcollection ofmoneyinanyformis strictlyprohibited.

➢ Detained and break-in-study candidates are allowed into the campus for academic purposes only with the permission from authorities.

➢ Misconduct committed by a student outside the Institute campus but having the effect of damaging, undermining & tarnishing the image & reputation of the institution will make the student concerned liable for disciplinary action commensurate with the nature and gravity of such misconduct.

> The disciplinary action committee constituted by the Principal, shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

> Grievance redressal committee, constituted by the Principal, shall deal with all grievances pertaining to the academic/ administrative and disciplinary matters.

> Allthestudentsmust abidebythecode andconduct rulesoftheInstitute.

17 MALPRACTICES

The Principal shall refer the cases of malpractices by students in internal assessment tests and end semester examinations, to a malpractice enquiry committee constituted for the purpose.The committee shall follow the approved scales of punishment.

Thecommitteeconsistsof:

1. HeadsofDepartment(Three)
2. Controllerof Examinations
3. DeputyControllerofExaminations

Table–8:Disciplinaryactionformalpractices/improperconductinexaminations

	Nature of Malpractices/Improper conduct	**Punishment**
1 (a)	If the candidate possesses or keeps accessible, any paper, note book, programmable calculators, mobile phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in the examination hall but has not made use of (material shall include any marks on the student's body that can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through mobile phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	If the candidate has copied in the examination hall from any paper, book, programmable calculators, palm computersoranyotherformof materialrelevanttothesubjectofthe	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appearedincludingpracticalexaminationsand projectwork.Heshallnotbepermittedto

	examination(theoryorpractical)in which the candidate is appearing.	appearfortheremainingexaminationsofthe subjectsofthatsemester/year.Thehallticket ofthecandidateistobecancelled.
3	If the candidate impersonates anyother candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (includingpracticals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over tothepoliceandacaseisregisteredagainst him.
4	Ifthecandidatesmugglesinananswer book or additional sheet or takes outor arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all other examinations. The continuation of thecoursebythecandidateissubjecttothe academic regulations in connection with forfeiture of seat.
5	If the candidate uses objectionable, abusive or offensive language in the answer paper or in letters to the examinersorwritestotheexaminer requestinghimtoawardpassmarks.	Cancellationoftheperformanceinthatsubject.
6	If the candidate refuses to obey the orders of the Chief Superintendent/Assistant - Superintendent/anyofficeron dutyor misbehaves or creates disturbance of any kind inandaround the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or anypersonon dutyinoroutsidethe examinationhallofanyinjurytohis	In case of students of the Institute, theyshall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has(have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischiefwhich resultsin damage to or destruction of property in the examination hall orany part of the Institute campus or engages in any other act which in the opinion of the officer ondutyamountstouseof unfair means or misconduct or has the tendency to disrupttheorderlyconductofthe examination.	
7	If the candidate leaves the exam hall taking away answer script or intentionallytearsofthescriptorany part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all other examinations. The continuation of thecoursebythecandidateissubjecttothe academic regulations in connection with forfeiture of seat.
8	If the candidate possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.Thecandidateisalsodebarred andforfeitstheseat.
9	If student of the Institute, who is not a candidate for the particular examination or any person not connected with the Institute indulgesin any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the Institute: Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work.He shall not be permitted for the remaining examinations of the subjects of that semester/ year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the Institute: Willbehandedovertopoliceandapolicecase willberegisteredagainst them.

10	If the candidate comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work. He shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11, shall be awarded suitable punishment.	

Note: Special squads may be formed to oversee the proper conduct of examinations.

18 OTHER MATTERS

18.1 Scribe facility is extended to B Tech students strictly following the guidelines issued under F. No. 16-110/2003-DD.III Dt. 26-02-2013 by the Ministry of Social Justice and Empowerment, Department of Disability Affairs, Govt. of India.

18.2 Students who are suffering from contagious diseases are not allowed to appear either continuous internal assessment or semester end examinations.

18.3 The students who participate in coaching/tournaments held at State/National/International levels through University/Indian Olympic Association during semester end examination period will be promoted to subsequent semesters till the entire programme is completed as per the guidelines of University Grants Commission Letter No. F.1-5/88 (SPE/PES), dated 18-08-1994.

18.4 Based on the recommendations of HOD & Principal, exemption from attending the class work shall be given to those students who secure placement and intend to join as the employer in VIII semester of B.Tech. Special Continuous Internal Evaluation (Assignment Tests, Sessional, etc.,) will be arranged to such candidates separately if necessary.

However, they shall appear for Semester End Examinations as per the Academic Calendar

18.5 The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the

Heads of the Departments in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved inthe Heads of the Departments Meetings, shall be reported to the academic council for ratification.

19   GENERAL

1   Wherever the words "he", "him", "his", occur in the regulations, theymay include "she", "her", "hers".

2   Theacademicregulationsshouldbereadasawholeforthepurposeofanyinterpretation.

3   In case of anydoubt or ambiguity in the interpretation of above rules, the decision of the principal is final.

20   INSTITUTERULESANDREGULATIONS

1   Useof**Mobilephones**isstrictlyprohibitedinsidethe Instituteacademicarea.

2   StudentsshouldcometoInstitutein**properdress**.

3   Allstudentsshouldwear**identitycards**intheInstitutepremisis.

4   Students should be present in their respective classrooms **before the commencement of class sharply**.

5   Students should not leave the Institute premises without prior permission of their respective Heads of the departments during Institute working hours.

6   Studentsshouldmaintainsilenceintheclassroomsduringworkingperiods.

7   Sitting / wandering of the students at the stair cases, corridors, cycle stands or the areas within the Institute premises is strictly prohibited.

8   UsageofVehiclehorninsidethe Institutepremisesis prohibited.

21   AMENDMENTSTOREGULATIONS

TheAcademicCouncilmay,fromtimetotime,revise,amendor change the regulations, schemes of examination and/or syllabi.

Oratory

PRINCIPAL

PVP19 FOUR YEAR B.TECH COURSE STRUCTURE

DEPARTMENT OF CIVIL ENGINEERING

I B.TECH - I – SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
1	19HS1101	Communicative English I	2	0	0	2	30	70	100
2	19BS1101	Engineering Mathematics I (Calculus and Algebra)	3	0	0	3	30	70	100
3	19BS1102	Chemistry of Materials	3	0	0	3	30	70	100
4	19ES1102	Problem Solving and Programming	**3**	**1**	**0**	4	30	70	100
5	19HS1151	Communicative English I Lab	0	0	3	1.5	25	50	75
6	19BS1151	Chemistry of Materials Lab	0	0	3	1.5	25	50	75
7	19ES1152	Problem Solving and Programming Lab	0	0	3	1.5	25	50	75
8	19ES1153	Basic Workshop	0	0	3	1.5	25	50	75
9	19MC1151	NCC/NSS/YOGA/Activity Clubs	0	0	2	0	100	-	100
Total			11	1	14	18	320	480	800

I B.TECH - II – SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
1	19HS1201	Communicative English II	2	0	0	2	30	70	100
2	19BS1201	Engineering Mathematics II (ODE,PDE and Multivariable Calculus)	3	0	0	3	30	70	100
3	19BS1204	Applied Physics	3	0	0	3	30	70	100
4	19ES1201	Basic Electrical and Electronics Engineering	3	1	0	4	30	70	100
5	19ES1203	Engineering Graphics	1	0	3	2.5	30	70	100
6	19HS1251	Communicative English II Lab	0	0	3	1.5	25	50	75
7	19BS1252	Applied Physics Lab	0	0	3	1.5	25	50	75
8	19ES1251	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	25	50	75
9	19CE3251	Civil Engineering Workshop	0	0	3	1.5	25	50	75
10	19MC1251	NCC/NSS/YOGA/Activity Clubs	0	0	2	0	100	-	100
Total			12	1	17	20.5	350	550	900

II B.TECH - I – SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
1	19BS1301	Engineering Mathematics	3	0	0	3	30	70	100

S.No	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
		III							
2	19BS1303	Life Sciences for Engineers	2	0	0	2	30	70	100
3	19ES1302	Design Thinking	2	0	0	2	30	70	100
4	19CE3301	Engineering Mechanics	3	0	0	3	30	70	100
5	19CE3302	Fluid Mechanics	3	0	0	3	30	70	100
6	19CE3303	Surveying	3	0	0	3	30	70	100
7	19MC1301	Environmental Sciences	3	0	0	0	100		100
8	19BS1351	Life Sciences for Engineers Lab	0	0	2	1	25	50	75
9	19ES1352	Design Thinking Lab	0	0	2	1	25	50	75
10	19CE3351	Fluid Mechanics Lab	0	0	3	1.5	25	50	75
11	19CE3352	Surveying Lab	0	0	3	1.5	25	50	75
TOTAL			19	0	10	**21**	**380**	**620**	**1000**

II B.TECH - II- SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
1	19BS1401	Engineering Mathematics- IV (Numerical Methods, Probability and Statistics)	3	0	0	3	30	70	100
2	19ES1401	AI Tools	2	0	0	2	30	70	100
3	19CE3401	Mechanics of Solids	3	0	0	3	30	70	100
4	19CE3402	Environmental Engineering	3	0	0	3	30	70	100
5	19CE3403	Geotechnical Engineering	3	0	0	3	30	70	100
6	19CE3404	Construction Materials & Concrete Technology	2	0	0	2	30	70	100
7	19MC1402	Constitution of India	3	0	0	0	100		100
8	19ES1451	AI Tools Lab	0	0	2	1	25	50	75
9	19CE3451	Mechanics of Solids Lab	0	0	3	1.5	25	50	75
10	19CE3452	Environmental Engineering Lab	0	0	3	1.5	25	50	75
11	19CE3453	Geotechnical Engineering Lab	0	0	3	1.5	25	50	75
12	19CE3454	Construction Materials & Concrete Technology Lab	0	0	3	1.5	25	50	75
TOTAL			19	0	14	**23**	**405**	**670**	**1075**

III B.TECH - I - SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
1	19ES1501	Internet of Things	2	0	0	2	30	70	100
2	19CE3501	Structural Analysis	3	0	0	3	30	70	100
3	19CE4501	Program Elective I	3	0	0	3	30	70	100
4	19CE3502	Highway Engineering	3	0	0	3	30	70	100
5	19CE3503	Design of Reinforced Concrete Structures	3	0	0	3	30	70	100
6		Interdisciplinary Elective I	3	0	0	3	30	70	100
7		Open Elective I	3	0	0	3	30	70	100
8	19ES1552	Internet of Things Lab	0	0	2	1	25	50	75
9	19CE3551	Highway Engineering Lab	0	0	3	1.5	25	50	75
10	19CE35510	Survey camp	-	-	-	2			
	TOTAL		20	0	5	24.5	260	590	850

III B.TECH - II - SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
1	19HS1601	Engineering Economics and Management	3	0	0	3	30	70	100
2	19CE3601	Design of Steel Structures	3	0	0	3	30	70	100
3	19CE4601	Program Elective II	3	0	0	3	30	70	100
4	19CE3602	Water Resources Engineering	3	0	0	3	30	70	100
5	19CE4602	Program Elective III	3	0	0	3	30	70	100
6	19MC1601	Engineering Ethics	3	0	0	0	100		100
7		Open Elective II	3	0	0	3	30	70	100
8	19CE3651	Architectural planning & CAD Lab	0	0	3	1.5	25	50	75
	TOTAL		21	0	3	19.5	305	470	775

IV B.TECH - I - SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
1	19HS1703	Construction management	3	0	0	3	30	70	100
2	19CE3701	Estimation and Costing	3	0	0	3	30	70	100
3	19CE4701	Program Elective – IV	3	0	0	3	30	70	100
4	19CE4702	Program Elective – V	3	0	0	3	30	70	100

5		Inter disciplinary Elective - II	3	0	0	3	30	70	100
6	19CE3751	Computer Applications In Civil Engineering Lab	0	0	3	1.5	25	50	75
7	19CE 3761	Project Phase - I	0	0	4	2	100	-	100
8	19CE3771	Industrial Training/Internship/; Research Projects in National Laboratories/ Academic Institutions				2	75	-	75
		TOTAL	15	0	7	**20.5**	**350**	**400**	**750**

IV B.TECH - II - SEMESTER

S.No.	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
1	19CE4801	Program Elective - VI	3	0	0	3	30	70	100
2		Inter disciplinary Elective - III	3	0	0	3	30	70	100
3	19CE 3861	Project Phase - II	0	0	14	7	100	100	200
		TOTAL	6	0	14	**13**	**160**	**240**	**400**

PROGRAM ELECTIVES

Program Elective- I

S.No.	Course Code	Course Title	L	T	P	C	Internals	Externals	Total
1	19CE4501A	Repairs, Renovation and Rehabilitation of Structures	3	0	0	3	30	70	100
2	19CE4501B	Foundation Engineering	3	0	0	3	30	70	100
3	19CE4501C	Pavement Analysis and Design	3	0	0	3	30	70	100
4	19CE4501D	Hydraulic Machines	3	0	0	3	30	70	100
5	19CE4501E	Pollution Prevention and Management	3	0	0	3	30	70	100

Program Elective- II

1	19CE4601A	Advanced Structural Analysis	3	0	0	3	30	70	100
2	19CE4601B	Rock Mechanics	3	0	0	3	30	70	100
3	19CE4601C	Traffic Engineering	3	0	0	3	30	70	100
4	19CE4601D	Hydropower Engineering	3	0	0	3	30	70	100
5	19CE4601E	Sanitary Engineering	3	0	0	3	30	70	100

Program Elective- III

1	19CE4602A	Advanced Reinforced Concrete Structures	3	0	0	3	30	70	100
2	19CE4602B	Advanced Foundation Engineering	3	0	0	3	30	70	100

3	19CE4602C	Remote Sensing and Geographic Information Systems	3	0	0	3	30	70	100
4	19CE4602D	Open Channel Hydraulics	3	0	0	3	30	70	100
5	19CE4602E	Air Pollution & Its Control	3	0	0	3	30	70	100
Program Elective- IV									
1	19CE4701A	Advanced Design of Steel Structures	3	0	0	3	30	70	100
2	19CE4701B	Soil Dynamics and Machine Foundations	3	0	0	3	30	70	100
3	19CE4701C	Transportation Infrastructure Engineering	3	0	0	3	30	70	100
4	19CE4701D	Irrigation Management	3	0	0	3	30	70	100
5	19CE4701E	Solid and Hazardous Waste Management	3	0	0	3	30	70	100
Program Elective- V									
1	19CE4702A	Prestressed Concrete	3	0	0	3	30	70	100
2	19CE4702B	Ground Improvement Techniques	3	0	0	3	30	70	100
3	19CE4702C	Urban Transport Planning	3	0	0	3	30	70	100
4	19CE4702D	Watershed Management	3	0	0	3	30	70	100
5	19CE4702E	Environmental Impact Assessment	3	0	0	3	30	70	100
Program Elective- VI									
1	19CE4801A	Earthquake Engineering	3	0	0	3	30	70	100
2	19CE4801B	Geosynthetics	3	0	0	3	30	70	100
3	19CE4801C	Road Safety Auditing	3	0	0	3	30	70	100
4	19CE4801D	Advanced Water Resources Engineering	3	0	0	3	30	70	100
5	19CE4801E	Industrial Waste Management	3	0	0	3	30	70	100
LIST OF OPEN ELECTIVES									
OPEN ELECTIVE - I	19ES5501A	Biotechnology and Society	3	0	0	3	30	70	100
	19ES5501B	Electrical Safety	3	0	0	3	30	70	100
	19ES5501C	Fundamentals of Cyber law	3	0	0	3	30	70	100
	19ES5501D	Environment and Ecology	3	0	0	3	30	70	100
	19HS5501A	Contemporary Relevance of Indian Epics	3	0	0	3	30	70	100
	19HS5501B	Indian National Movement	3	0	0	3	30	70	100
	19HS5501C	Engineering for Community Service	3	0	0	3	30	70	100
	19HS5501D	Personality Development	3	0	0	3	30	70	100

	19HS5501E	Introduction to International Business	3	0	0	3	30	70	100
	19HS5501G	Indian History	3	0	0	3	30	70	100
OPEN ELECTIVE - II	19ES5601A	Environmental Management	3	0	0	3	30	70	100
	19ES5601B	Telecommunication for Society	3	0	0	3	30	70	100
	19HS5601A	German for Beginners	3	0	0	3	30	70	100
	19HS5601C	Analytical Essay for Writing	3	0	0	3	30	70	100
	19HS5601D	Indian Economy	3	0	0	3	30	70	100
	19HS5601E	Public Administration	3	0	0	3	30	70	100
	19HS5601F	National Service Scheme	3	0	0	3	30	70	100
	19ES5601G	Professional Communication	3	0	0	3	30	70	100
	19HS5601H	Basics of Finance	3	0	0	3	30	70	100
	19HS5601I	Basics of Marketing	3	0	0	3	30	70	100

LIST OF INTERDISCIPLINARY ELECTIVES

	19CS2501A	Data Base Management	3	0	0	3	30	70	100
Interdisciplinary Elective - I	19HS2501A	Quantitative Techniques for Management	3	0	0	3	30	70	100
	19IT2501C	OOP with C++	3	0	0	3	30	70	100
	19ME2501A	Computational Methods	3	0	0	3	30	70	100
Interdisciplinary Elective - II	19EE2701A	Renewable Energy Resources	3	0	0	3	30	70	100
	19IT2701A	Web Technologies	3	0	0	3	30	70	100
	19ME2701A	Optimization Techniques	3	0	0	3	30	70	100
	19ME2701B	Project Management & Optimization	3	0	0	3	30	70	100
Interdisciplinary Elective - III	19CS2801A	Introduction to Python programming	3	0	0	3	30	70	100
	19EC2801A	Instrumentation and Sensor Technologies of Civil Engineering Applications	3	0	0	3	30	70	100
	19HS2801A	Logistics and Supply Chain Management	3	0	0	3	30	70	100
	19ME2801A	Total Quality Management	3	0	0	3	30	70	100

I - SEMESTER SYLLABUS

19HS1101 - COMMUNICATIVE ENGLISH - 1

Course Category:	Humanities and SocialSciences		Credits:	2
Course Type:	Theory		Lecture-Tutorial-Practical:	2-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Comprehend** how to apply parts of speech in a sentence and construct a paragraph.	K2
CO2	**Apply** grammar to formulate text using punctuation.	K3
CO3	**Evaluate** reading texts and use correct tense forms for effective communication.	K5
CO4	**Analyse** reading texts and to write summaries based on comprehension of the texts.	K4
CO5	**Create** awareness on how to write correct sentences in English and comprehend the text.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Reading:** Skimming to get the main idea of a text; Scanning to look for specific pieces of information. **Reading for Writing:** Beginnings and endings of paragraphs - Introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; Word forms: Verbs, Nouns, Adjectives and Adverbs; Nouns: countables and uncountables; singular and plural; Basic sentence structures; Simple question form - wh-questions; Word order in sentences.	CO1
UNIT-2	**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraphtogether. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; Mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; Use of articles and zero article; prepositions	CO2
UNIT-3	**Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - Tenses; Subject-verb agreement; Direct and indirect speech, Reporting verbs for academic purposes.	CO3
UNIT-4	**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in	CO4

	figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; Degrees of comparison; Use of antonyms	
UNIT-5	**Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences **Grammar and Vocabulary:** Editing short texts – Identifying and correcting common errors in grammar and usage (Articles, prepositions, Tenses, Subject-verb agreement)	CO5

Learning Resources

Text Books	1. Prabhavathy Y, M.Lalitha Sridevi, Ruth Z. Hauzel, "English all round communication skills for undergraduate students", Orient Black Swan, 2019
Reference Books	1. Bailey, Stephen. *Academic writing: A handbook for international students.* Routledge, 2014. 2. SkillfulLevel2Reading&WritingStudent'sBookPack(B1)MacmillanEducational. 3. Hewings, Martin. *Cambridge Academic English (B2).* CUP, 2012
e-Resources& other digital material	Grammar/Listening/Writing 1-language.com; http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary English Language Learning Online; http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/; http://www.nonstopenglish.com/ https://www.vocabulary.com/; BBC Vocabulary Games Free Rice Vocabulary Game Reading https://www.usingenglish.com/comprehension/; https://www.englishclub.com/reading/short-stories.htm; https://www.english-online.at/ All Skills https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/ Online Dictionaries Cambridge dictionary online; MacMillan dictionary; Oxford learner's dictionaries

19BS1101 - ENGINEERING MATHEMATICS – 1 (CALCULUS AND ALGEBRA)

Course Category:	Basic Sciences		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Utilize** the techniques of matrix algebra that is needed by engineers for practical Applications	K3
CO2	**Apply** mean value theorems to engineering problems	K3
CO3	**Utilize** functions of several variables in optimization	K3
CO4	employ the tools of calculus for **calculating** the areas	K3
CO5	**Calculate** volumes using multiple integrals	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2												2
CO2	3	2												2
CO3	3	2												2
CO4	3	2												2
CO5	3	2												2
Avg.	**3**	**2**												2

1- Low	2-Medium	3-High

Course Content

UNIT-1	**MATRICES:** Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous linear equations. Eigen values, Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalization of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.	CO1
UNIT-2	**MEAN VALUE THEOREMS:** Rolle 's Theorem, Lagrange 's mean value theorem, Cauchy 's mean value theorem, Taylor 's and Maclaurin 's theorems with remainders (without proof).	CO2
UNIT-3	**MULTIVARIABLE CALCULUS:** Partial derivatives, total derivatives, chain rule, change of variables, Jacobian, maxima and minima of functions of two variables, method of Lagrange multipliers.	CO3
UNIT-4	**Multiple Integrals-I:** Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves.	CO4
UNIT-5	**Multiple Integrals-II:** Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volume as triple integral.	CO5

Learning Resources

Text Books	1. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017
	2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley&Sons, 2018
Reference	1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e,

Books	Alpha Science International Ltd., 2002.
	2. GeorgeB.Thomas,MauriceD.WeirandJoelHass,ThomasCalculus,13/e,Pearson Publishers, 2013.
	3. GlynJames,AdvancedModernEngineeringMathematics,4/e,Pearsonpublishers, 2011.
e-Resources& other digital material	1. www.nptelvideos.com/mathematics/
	2. https://nptel.ac.in/courses/111104025/
	3. https://nptel.ac.in/courses/122101003/

19BS1102 - CHEMISTRY OF MATERIALS

Course Category:	Basic Sciences		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**List** the difference between temporary and permanent hardness of water.	K1
CO2	**Know** the principles and applications of solar and wind energy.	K2
CO3	**Identify** different organic coatings.	K1
CO4	**Analyse** the importance of nano and smart materials.	K4
CO5	**Distinguish** the principles of BET and TEM.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													1
CO2	3		2											1
CO3	3													1
CO4	3	2												1
CO5	3													1
Avg.	3	2	2											1

1- Low	2-Medium	3-High

Course Content

UNIT-1	**WATER TECHNOLOGY**: Introduction –Hard and Soft water, Estimation of hardness by EDTA Method - Boiler troubles- scale and sludge-priming and foaming, specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards, Industrial water treatment – zeolite and ion- exchange processes- desalination of brackish water, reverse osmosis (RO) and electro dialysis.	CO1
UNIT-2	**ENERGY SOURCES AND APPLICATIONS**: Electrode potential, determination of single electrode potential –Nernst's equation, reference electrodes, Weston Cd Cell, hydrogen and calomel electrodes – electrochemical series and its applications – primary cell, dry or Leclanche cell – secondary cell, lead acid storage cell, nickel- cadmium cell – lithium batteries (Lithium-MnO2) – fuel cell, hydrogen-oxygen fuel cell, Solar energy, photovoltaic cell and applications	CO2
UNIT-3	**CORROSION ENGINEERING**: Corrosion: Definition – theories of corrosion, dry corrosion and electrochemical corrosion – factors affecting corrosion, nature of the metal and nature of the environment. Corrosion controlling methods: Sacrificial and Impressed current cathodic protection, Metallic coatings, anodic coatings, cathodic coating, galvanizing and tinning, anodic inhibitors and cathodic inhibitors – organic coatings, paints and varnishes (constituents and their functions).	CO3
UNIT-4	**ENGINEERING MATERIALS AND POLYMERS** Steel – Types of Steel, chemical composition – applications of alloy steels Cement: Portland cement, constituents, Manufacture of Portland Cement, chemistry of setting and hardening of cement (hydration, hydrolysis, equations). Polymers: Introduction, differences between thermoplastic and thermosetting resins, Preparation, properties and uses of polystyrene and polyphosphazines.	CO4

UNIT-5	**NANO AND SMART MATERIALS**: Introduction to Nano materials, chemical synthesis of nanomaterials: Sol-gel method, reverse micellar method,CharacterizationofnanoparticlesbyBETmethod,characterization of nano materials by TEM (includes basic principle of TEM), Applications of nanomaterials in waste water treatment, lubricants and engines. **Smart Materials:** Introduction Types of smart materials self-healing materials Shape memory alloys and Uses of smart materials	CO5

Learning Resources

Text Books	1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, DhanapatRai&Sons,(2014). 2. B.K. Sharma, Engineering Chemistry, Krishna Prakasham,(2014).
Reference Books	1. SashiChawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons,(2003) 2. .B.S Murthy and P. Shankar, A Text Book of Nano Science and Nano Technology, University Press(2013). 3. S.S. Dara, A Textbook of Engineering Chemistry, S. Chand&Co,(2010) 4. V.Raghavan, A Material Science and Engineering, Prentice-Hall India Ltd,(2004). 5. N.Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications(2014). 6. K. SeshaMaheshwaramma and MridulaChugh, Engineering Chemistry, Pearson India Ednservices,(2016).
e-Resources& other digital material	1. https://nptel.ac.in/courses/105105178/ 2. http://202.53.81.118/course/view.php?id=82

19ES1102 - PROBLEM SOLVING AND PROGRAMMING

Course Category:	Engineering Sciences									Credits:		4	
Course Type:	Theory									Lecture-Tutorial-Practical:		3-1-0	
Prerequisites:	Nil									Continuous Evaluation:		30	
										Semester End Evaluation:		70	
										Total Marks:		100	

Course Outcomes

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

CO1	**Develop** algorithm and flowchart for simple problems.	K6
CO2	**Understand** the structure, fundamentals and decision-making statements in C.	K2
CO3	Choose suitable iterative statements and arrays to **solve** the problems.	K3
CO4	**Solve** problems using functions and pointers.	K3
CO5	**Apply** the structures, unions and file operations in a specific need.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Introduction to Computer Problem-Solving** – Introduction, The Problem-Solving Aspect, Top-Down Design, Fundamental Algorithms –Exchanging the values of two variables, Counting, Summation of a Set of Numbers, Factorial Computation, Sine Function Computation, Generation of the Fibonacci Series. Basics of Flowcharts.	CO1
UNIT-2	**Introduction to C:** Introduction, Structure of C Program, A Simple C Program, C-Tokens, Basic Data types, Variables, Constants, Input / Output statements, Operators, Type conversion and Type casting. **Conditional Branching Statements:** if, if-else, if-else-if Statements and Switch case.	CO2
UNIT-3	**Iterative Statements:** while, for and do - while loops, Nested loops, break and continue statements. **Arrays:** Declaration, accessing array elements, Storing values, Operations on arrays, multi-dimensional arrays. **Strings:** Introduction, String manipulation functions.	CO3
UNIT-4	**Functions:** Introduction, Using Functions, Function declaration, Function definition and Function call, Parameter passing, Passing arrays to functions, Recursion, Storage classes. **Pointers:** Declaration and Initialization of pointer variables, Pointer arithmetic, Pointers and arrays, Pointer to pointer, Array of pointers, Pointers and functions, Dynamic memory allocation.	CO4
UNIT-5	**Structures:** Introduction, Nested structures, Array of structures, Structures and functions, Unions. **Files in C:** Using Files in C, read data from files, Writing data to files, Random access to files of records.	CO5

Learning Resources

Text Books	1. R.G.Dromey,Howto SolveitbyComputer,1/e,PearsonEducation,2006.(forUnitI).
	2. ReemaThareja,ProgramminginC,OxfordUniversityPress,AICTEEdition,2018.
Reference Books	1. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning, 2007.
	2. Pradip Dey, Manas Ghosh, Programming in C, Oxford University Press, AICTE Edition,
	3. B. Gottfried, Programming with C, 3/e, Schaum's outlines, McGraw Hill (India), 2017.
	4. Jeri R. Hanly, Ellot B. Koffman, Problem Solving and Program Design in C, 5/e, Pearson.
e-Resources& other digital material	1. http://cprogramminglanguage.net/
	2. https://www.geeksforgeeks.org/c-programming-language/
	3. https://nptel.ac.in/courses/106105085/4

19HS1151- COMMUNICATIVE ENGLISH – 1 LAB

Course Category:	Humanities and SocialSciences		Credits:	1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-3
Prerequisites:	Nil		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Remember**andunderstandthedifferentaspectsoftheEnglishlanguageproficiency withemphasisonLSRWskills	K1
CO2	**Apply**communicationskillsthroughvariouslanguagelearningactivities	K3
CO3	**Analyze**thecomprehensiveabilityandlogicalthinkingforbetterlisteningand speaking.	K4
CO4	**Evaluate**andexhibitacceptableetiquetteessentialinsocialandprofessional situations.	K5
CO5	**Create**awarenessonhowtoimprovepresentationskillsin English.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									2	3		3	1	
CO2									2	3		3	1	
CO3									2	3		3	1	
CO4									2	3		3	1	
Avg.									**2**	**3**		**3**	**1**	

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Identifyingthetopic,thecontextandspecificpiecesofinformationby listeningtoshortaudiotextsandansweringaseriesofquestions.	CO1
Experiment No.2	Askingandansweringgeneralquestionsonfamiliartopicssuchashome,family,work,studiesandinterests;introducingoneselfand others.	
Experiment No.3	Answeringaseriesofquestionsaboutmainideaandsupportingideas afterlisteningto audio texts.	CO2
Experiment No.4	Discussioninpairs/smallgroupsonspecifictopicsfollowedbyshort structuredtalks.	
Experiment No.5	Listeningforglobalcomprehensionandsummarizingwhatislistenedto.	CO3
Experiment No.6	Discussingspecifictopicsinpairsorsmallgroupsandreportingwhatisdiscussed	
Experiment No.7	Making predictions while listening toconversations/transactionaldialogues without video; listeningwithvideo.	CO4
Experiment No.8	RoleplaysforpracticeofconversationalEnglishinacademiccontexts(formal andinformal)-askingforandgivinginformation/directions.	
Experiment No.9	Identifyingkeyterms,understandingconceptsandansweringa series of relevantquestionsthattestcomprehension.	CO5
Experiment No.10	Formaloralpresentationsontopicsfromacademiccontexts-withoutthe useofPPT slides.	

Learning Resources

Reference	1. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley

Books	ELT; 2nd Edition, 2018. 2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 3. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012
e-Resources& other digital material	Grammar/Listening/Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Listening https://learningenglish.voanews.com/z/3613; http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/BBC; Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises All Skills https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/ Online Dictionaries Cambridge dictionary online; MacMillan dictionary; Oxford learner's dictionaries

19BS1151- CHEMISTRY OF MATERIALS LAB

Course Category:	Basic Sciences		Credits:	1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-3
Prerequisites:	Nil		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Illustrate**differentores(Fe,Cr&Cu)andtheirusage.	K3
CO2	**Compare**theviscositiesofoils.	K2
CO3	**Experiment**withthephysicalparametersoforganic compounds.	K3
CO4	**Apply**theTLCtechniquefortheidentificationoforganiccompounds.	K3
CO5	**Analyze**thequalityofgroundwatersample.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2											1
CO2	3		2											1
CO3	3		2											1
CO4	3		2											1
Avg.	**3**		**2**											1

1- Low	2-Medium	3-High

Course Content

Experiment No.1	EstimationofcalciuminPortlandcement	CO1
Experiment No.2	Determinationofchromium(VI)inpotassiumdichromate	
Experiment No.3	Determinationofviscosityofaliquid	CO2
Experiment No.4	Determinationofsurfacetensionofaliquid	
Experiment No.5	Determinationofsulphuricacidinlead-acidstoragecell	CO3
Experiment No.6	DeterminationofstrengthofanacidbypHmetric method	
Experiment No.7	DeterminationofHardnessofagroundwatersample	CO5
Experiment No.8	EstimationofactivechlorinecontentinBleachingpowder	CO3
Experiment No.9	Thinlayerchromatography	CO4
Experiment No.10	PreparationofPhenol-formaldehyderesin	CO3

Learning Resources

Text Books	1. MendhamJ,DenneyRC,BarnesJD,ThosmasMandSivasankar BVogel's Quantitative ChemicalAnalysis6/e,Pearsonpublishers(2000).
Reference Books	1. N.KBhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company(2007).
e-Resources& other digital material	1. https://nptel.ac.in/courses/105105178/ 2. http://202.53.81.118/course/view.php?id=82

19ES1152- PROBLEM SOLVING AND PROGRAMMING LAB

Course Category:		Engineering Sciences		Credits:	1.5
Course Type:		Laboratory		Lecture-Tutorial-Practical:	0-0-3
Prerequisites:		Nil		Continuous Evaluation:	25
				Semester End Evaluation:	50
				Total Marks:	75

Course Outcomes

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

CO1	**Build** algorithm and flowchart for simple problems.	K6
CO2	**Use** suitable control structures to **solve** problems.	K3
CO3	**Use** suitable iterative statements and arrays to **solve** the problems.	K3
CO4	**Implement** Programs using functions and pointers.	K3
CO5	**Develop** code for complex applications using structures, unions and file handling features.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Draw flowcharts for fundamental algorithms.	CO1
Experiment No.2	C Programs to demonstrate C-tokens.	CO2
Experiment No.3	C Programs on usage of operators.	
Experiment No.4	C Programs to demonstrate Decision making and branching (Selection)	
Experiment No.5	C programs to demonstrate different loops.	CO3
Experiment No.6	C programs to demonstrate 1-D arrays.	
Experiment No.7	C programs to demonstrate multi-dimensional arrays.	
Experiment No.8	C programs to perform operations on strings with String handling functions and without String handling functions.	
Experiment No.9	C programs to demonstrate functions.	CO4
Experiment No.10	C programs on pointers.	
Experiment No.11	C programs on structures and unions.	CO5
Experiment No.12	C programs to demonstrate files.	

Learning Resources

Text Books	1. R.G. Dromey, How to Solve it by Computer, 1/e, Pearson Education, 2006.
	2. Reema Thareja , Programming in C, Oxford University Press, AICTE Edition, 2018.
Reference Books	1. B. A. Forouzan and R. F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3/e, Cengage Learning, 2007.
	2. Pradip Dey, Manas Ghosh, Programming in C, Oxford University Press, AICTE Edition,
	3. B. Gottfried, Programming with C, 3/e, Schaum's outlines, McGraw Hill (India), 2017.
	4. Jeri R. Hanly, Ellot B. Koffman, Problem Solving and Program Design in C, 5/e, Pearson.
e-Resources& other digital	1. http://cprogramminglanguage.net/
	2. https://www.geeksforgeeks.org/c-programming-language/

material	3. https://nptel.ac.in/courses/106105085/4

19ES1153- BASIC WORKSHOP

Course Category:	Engineering Sciences		Credits:		1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:		0-0-3
Prerequisites:	Nil		Continuous Evaluation:		25
			Semester End Evaluation:		50
			Total Marks:		75

Course Outcomes

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

CO1	**Apply** woodworkingskillsinrealworldapplications	K3
CO2	**Build** differentpartswithmetalsheetsinrealworldapplications.	K6
CO3	**Apply** fittingoperationsinvariousapplications.	K3
CO4	**Apply** differenttypesofbasicelectriccircuitconnectionsanddemonstrate soldering.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					1			3		1		1	
CO2	3					1			3		1		1	
CO3	3					1			3		1		1	
CO4	3					1			3		1		1	
Avg.	3					1			3		1		1	

1- Low	**2-Medium**	**3-High**

Course Content

Wood Working	Familiarity with different types of woods and tools used in woodworking and make following joints i) Half–Lapjoint. ii) MortiseandTenon joint. iii) CornerDovetailjointorBridlejoint.	CO1
SheetMetal Working	Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GIsheets i) Taperedtray ii) Conical funnel iii) Elbow pipe	CO2
Fitting	Familiarity with different types of tools used in fitting and do thefollowing fitting exercises i) V-fit ii) Semi-circularfit iii) Bicycletirepunctureandchangeoftwowheelertire	CO3
Electrical	Familiaritieswithdifferenttypesofbasicelectricalcircuitsand makethe followingconnections i) PreparationofacircuitforParallelandseries connection. ii) Preparation of a circuit Go down lighting using Two wayswitch and tube light. iii)Solderingofwires	CO4

Learning Resources

Text Books	1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech Publishers. 2. Workshop Manual / Venkat Reddy/ BS Publications/Sixth Edition

II - SEMESTER SYLLABUS

19HS1201 - COMMUNICATIVE ENGLISH - II

Course Category:	Humanities and SocialSciences		Credits:		2
Course Type:	Theory		Lecture-Tutorial-Practical:		2-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Demonstrate**goodwritingskillsforeffectiveparaphrasingandsynthesizinginformation	K2
CO2	**Analyze**factsfromopinionswhilereadingand writingformalletters andemailsusinga rangeofvocabularyinformalwriting	K4
CO3	**Evaluate**readingtextsandlearngoodwritingskillsforeffectiveargumentativeessays and formalcorrespondence.	K5
CO4	**Understand**thestructureofprojectreportsapplyinggrammaticallycorrectstructures andknowledgeofgrammar	K2
CO5	**Develop**advancedreadingskillsfordeeperunderstandingoftextsandemployability skills.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Reading**: Reading for presenting - strategies to select, compile and synthesize information for presentation-Comprehending a wide range of texts -Reading to recognize academic style **Reading for Writing**: Paraphrasing - using quotations and in-text references; using academic style - avoiding colloquial words and phrases - Writing an essay after researching a topic - Citing the sources used Grammar and Vocabulary: Academic verbs in context; formal words and phrases- Awareness about Root words	CO1
UNIT-2	**Reading:** Recognizing formal and informal styles -Recognizing thedifferencebetween facts and opinions - Identifying and understanding different perspectives **Writing:** Letter writing and e mail writing - Structure, Conventions and Etiquette – Informal, semi-formal and formal (enquiry, complaints, seeking permission, seeking internship - Re-draft a piece of text from a different perspective - Writing brief critical reviews of short texts **Grammar and Vocabulary:** Agreement: Subject-verb, Noun-pronoun; Editing short texts - Phrasal verbs - Phrasal prepositions - Avoiding clichés	CO2
UNIT-3	**Reading:** Identifying claims, evidences, views/opinions, purpose, and stance/position -Understand the correlation between a talk and a reading text based on inferences made. **Writing:** Writing structured analytical and argumentative essays on general topics using suitable claims and evidences with the sources cited-Peer review of the essays written	CO3

	Grammar and Vocabulary: Language for different functions such as stating a point, expressing opinion, Agreeing/disagreeing, Adding information to what someone has stated, and asking for clarification - Modifiers and misplaced modifiers	
UNIT-4	**Reading:** Reading varied text types - Structure and contents of a formal report- Sectionsinareportandunderstandingthepurposeofeachsection- Significance of references **Writing:**Writingreports **GrammarandVocabulary:**Activeandpassivevoice-Useofpassiveverbs in academic writing	CO4
UNIT-5	**Reading:**Readingforinferentialcomprehension **Writing:** Writing one's CV and cover letter - Applying for a job/internship **GrammarandVocabulary:**Reinforcinglearning-Editone'swritingto correct common errors in grammar and usage- Use appropriate vocabularyfor speaking and writing – Various purposes	CO5

Learning Resources

Reference Books	1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014. 2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 3. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012(Student Book, Teacher Resource Book, CD & DVD)
e-Resources& other digital material	Grammar/Listening/Writing: 1-language.com; http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary: English Language Learning Online; http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/; http://www.nonstopenglish.com/ https://www.vocabulary.com/; BBC Vocabulary Games Free Rice Vocabulary Game Reading: https://www.usingenglish.com/comprehension/; https://www.englishclub.com/reading/short-stories.htm; https://www.english-online.at/ All Skills: https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/ Online Dictionaries: Cambridge dictionary online; MacMillan dictionary; Oxford learner's dictionaries

19BS1201 - ENGINEERING MATHEMATICS – II (ODE, PDE AND MULTIVARIABLE CALCULUS)

	Course Category:	Basic Sciences		Credits:		3
	Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
	Prerequisites:	19BS1101-Engineering Mathematics – I (Calculus and Algebra)		Continuous Evaluation:		30
				Semester End Evaluation:		70
				Total Marks:		100

Course Outcomes

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

CO1	**Solve** the differential equations related to various engineering fields.	K3
CO2	**Solve** the linear differential equation with constant coefficients.	K3
CO3	**Identify** solution methods for partial differential equations that model physical processes.	K1
CO4	**Interpret** the physical meaning of gradient, curl and divergence.	K2
CO5	**Determine** the work done against a force field, circulation and flux using vector calculus.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2											2	
CO2	3	2											2	
CO3	3	2											2	
CO4	3	2											2	
CO5	3	2											2	
Avg.	**3**	**2**											2	

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**Linear Differential Equations of Higher Order:** Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.	CO1
UNIT-2	**Equations Reducible to Linear Differential Equations and Applications:** Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.	CO2
UNIT-3	**Partial Differential Equations:** First order partial differential equations, solutions of first order linear PDEs, Charpit's method, solutions to homogenous and non-homogenous linear partial differential equations.	CO3
UNIT-4	**Multivariable Calculus (Vector Differentiation):** Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities	CO4
UNIT-5	**Multivariable Calculus (Vector Integration):** Line integral-circulation- work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).	CO5

Learning Resources

Text	1. Erwin Kreyszig, Advanced Engineering Mathematics,10/e, John Wiley & Sons,

Books	2018
	2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
Reference Books	1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha ScienceInternational Ltd., 2002.
	2. GeorgeB.Thomas,MauriceD.WeirandJoelHass,ThomasCalculus,13/e,Pearson Publishers, 2013.
	3. GlynJames,AdvancedModernEngineeringMathematics,4/e,Pearsonpublishers, 2011.
e-Resources& other digital material	1. www.nptelvideos.com/mathematics/
	2. https://nptel.ac.in/courses/111104025/
	3. https://nptel.ac.in/courses/122101003/

19BS1204 - APPLIED PHYSICS

Course Category:	Basic Sciences		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Estimate** forces and moments in mechanical systems using scalar and vector techniques.	K5
CO2	**Apply** the concepts of strain, internal force, stress and equilibrium to deformation of solids.	K3
CO3	**Explain** the fundamental theory for the analysis of heat transfer processes in solids and liquids and to apply basic principles of heat transfer in design of refrigerators and heaters.	K2
CO4	**Describe** the fundamental principles of acoustics with emphasis on physical mechanisms, law and relationships.	K2
CO5	**Outline** the basic principle and operation of different types of *sensors*.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3											3	
CO2	3	3											3	
CO3	3	3											3	
CO4	3	3											3	
CO5	3	3											3	
Avg.	**3**	**3**											3	

1- Low	2-Medium	3-High

Course Content

UNIT-1	**MECHANICS** Basic laws of vectors and scalars; Rotational frames; Conservative and non-conservative forces; F = - grad V; Central forces; Elliptical, parabolic and hyperbolic orbits; Noninertial frames of reference; Centripetal acceleration; Harmonic oscillator; Damped harmonic motion; Forced oscillations and resonance. Degrees of freedom.	CO1
UNIT-2	**ELASTICITY** Concepts of elasticity and plasticity, stress and strain, Hooke's law, different moduli of elasticity, Poisson's ratio, strain energy, stress-strain diagram, elastic behavior of a material, factors affecting elasticity, relation between different moduli of elasticity, determination of elastic moduli	CO2
UNIT-3	**THERMAL PROPERTIES** Transfer of heat energy; Thermal expansion of solids and liquids; Expansion joints - bimetallic strips; Thermal conduction, convection and radiation and their fundamental laws; Heat conductions in solids; Thermal conductivity- Forbe's and Lee's disc method: theory and experiment; Applications (qualitative only): heat exchangers, refrigerators, ovens and solar water heaters.	CO3
UNIT-4	**ACOUSTICS** Characteristics of sound waves; Weber-Fechner Law; Absorption coefficient, determination of absorption coefficient; Reverberation time; Sabine's formula,	CO4

	derivation of Sabine's formula using growth and decay method; Intensity of sound; Acoustics of Buildings, Acoustic requirements of a good auditorium.	
UNIT-5	**SENSORS** Sensors (qualitative description only); Different types of sensors and applications; Strain and pressure sensors - Piezoelectric, magneto strictive sensors; Fibre optic methods of pressure sensing; Temperature sensor - bimetallic strip, pyroelectric detectors; Hall-effect sensor; Smoke and fire detectors.	CO5

Learning Resources

Text Books	1. D.KleppnerandRobertKolenkow"AnIntroductiontoMechanics–II"Cambridge University Press, 2015. 2. ATextbookofEngineeringPhysics,Volume-IByM.N.Avadhanulu&T.V.S.Arun Murthy S Chand. 3. IanRSinclair,SensorandTransducers3/e,2001,Elsevier (Newnes)
Reference Books	1. M K Varma "Introduction to Mechanics"-Universities Press,2015. 2. PrithwirajPurkait, BudhadityaBiswas and ChiranjibKoley, Chapter 11 Sensors and Transducers, Electrical and Electronics Measurements and Instrumentation, 1/e., 2013 McGraw Hill Education (India) Private Limited, 2013.
e-Resources& other digital material	1. http://nptel.ac.in/courses.phphttp://jntuk-coeer 2. http://freevideolectures.com/Course/3048/Physics-of-Materials/36

19ES1201 - BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Course Category:	Engineering Sciences		Credits:		4
Course Type:	Theory		Lecture-Tutorial-Practical:		3-1-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Familiarize** the basic DC and AC networks used in electrical and electronic circuits.	K2
CO2	**Explain** the concepts of electrical machines and their characteristics.	K2
CO3	**Identify** the importance of transformers in transmission and distribution of electric power	K1
CO4	**Impart** the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).	K3
CO5	**Expose** basic concepts and applications of Operational Amplifier and configurations	K2

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					1		1		2	1	2	
CO2	3	2				1	1		1		2	1		
CO3	3	2				1	1		1		2	1		
CO4	3	2					1		1		2	1	2	2
CO5	3	2					1		1		2	1	2	2
Avg.	**3**	**2**				**1**	**1**		**1**		2	1	2	2

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	Basic laws and Theorems: Ohms law, Kirchoff's Laws, series and parallel circuits, source transformations, delta-wye conversion. Mesh analysis, nodal analysis. Linearity and superposition theorem, Thevenin's and Norton's theorem with simple examples, maximum power transfer theorem with simple examples	CO1
UNIT-2	DC Machines: Constructional features, induced EMF and torque expressions, different types of excitation, performance characteristics of different types of dc machines, Starters: 2-point, 3-point starters, losses and efficiency, efficiency by direct loading	CO2
UNIT-3	Transformers: Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short- circuit tests and determination of efficiency. Three Phase Induction Motors: Construction, working principle of three phase induction motor, Torque and Torque-Slip characteristics.	CO3
UNIT-4	Semiconductor Devices: p-n Junction diode - Basic operating principle, current-voltage characteristics, rectifier circuits (half-wave, full-wave, rectifier with filter capacitor), Zener diode as Voltage Regulator; Metal oxide semiconductor field effect transistor (MOSFET): Operation of NMOS and PMOS FETs, MOSFET as an amplifier and switch.	CO4

UNIT-5	Operational Amplifiers: The Ideal Op Amp, The Inverting Configuration, The closed loop gain, Effect of Finite open-loop gain, The Noninverting Configuration, The closed loop gain, Characteristics of Non Inverting Configuration, Effect of finite open loop gain, the voltage follower, Difference amplifiers, A Single Op-amp difference amplifier.	CO5

Learning Resources

Text Books	1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1stedition, McGraw Hill Education (India) Private Limited, 2017.
	2. B.L.Theraja, Fundamentals of Electrical Engineering and Electronics, 1stedition,S.Chand Publishing, New Delhi, 2006.
	3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, Oxford University Press, 2014.
Reference Books	1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education,2011.
	2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
	3. R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi,2012.
e-Resources& other digital material	1. NPTEL :: Electrical Engineering - NOC:Fundamentals of Electrical Engineering
	2. NPTEL :: Electrical Engineering - NOC:Fundamentals of Electrical Engineering

19ES1203 - ENGINEERING GRAPHICS

Course Category:	Engineering Sciences						Credits:		2.5	
Course Type:	Theory						Lecture-Tutorial-Practical:		1-0-3	
Prerequisites:	Nil						Continuous Evaluation:		30	
							Semester End Evaluation:		70	
							Total Marks:		100	

Course Outcomes

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

CO1	**Develop** Conicsectionsandcurvesusedinengineeringpractice.	K6
CO2	**Draw** Orthographicprojectionsofpoints,lines,planesandsolids.	K6
CO3	**Draw** Isometricandorthographicviews.	K6
CO4	**Develop** oflateralsurfacesofsolids.	K6
CO5	**Demonstrate** featuresofCADpackages.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3									3	1		3	
CO2	3									3	1		3	
CO3	3									3	1		3	
CO4	3									3	1		3	
CO5	3				3					3	1		3	3
Avg.	**3**				**3**					3	1		3	3

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Introduction to Engineering Graphics**: Principles of Engineering Graphics and their significance- Conventions in drawing, lettering, dimensioning, BIS conventions. a) **Conicsections**:Constructionofellipse,parabolaandhyperbola (general method only) b) **Cycloidalcurves**:Cycloid,EpicycloidandHypocycloid **Involutes**:InvoluteofregularpolygonsandCircle.	CO1
UNIT-2	**Projection of points, lines and planes:** Projection of points in different quadrants, lines inclined to one and both the reference planes,findingtruelengthandinclinationmadebytheline. Projectionsofregularplanesurfaces.	CO2
UNIT-3	**Projections of solids:** Projections of regular solids such as cube, prism, p cylinder and cone (Treatment limited to solids inclined to one of the referen**Sectionsofsolids:**Sectionplanesandsectionalviewofrightregular solids-cube,prism,cylinder,pyramidandcone.Trueshapeofthe section. (Treatment limited to the solids perpendicular to one of the principal planes)	CO3
UNIT-4	**Orthographic Views:** Systems of projections, conversion of isometric view to orthographic view. **IsometricProjections:**Principlesofisometricprojection-isometric scale;isometricviews:lines,planesand solids.(Treatmentislimitedto simple objects only)	CO4
UNIT-5	**Developmentofsurfaces:**Developmentoflateralsurfacesofright regularsolids-prism,cylinder,pyramid,coneandtheirsectionalparts. (Treatmentlimitedtosolidsperpendiculartooneoftheprincipalplanes) **Introduction to CAD**: Basic drawing, editing and dimensioning commands: line, circle, rectangle, erase, view, undo, redo, snap, edit, move, copy, rotate, scale, mirror, layer, template, polyline, trim, extend, stretch, fillet, array,	CO5

	dimension.	
Learning Resources	

Text Books	1. N.D.Bhatt,EngineeringDrawing,53/e,CharotarPublishers,2016. 2. K.L.Narayana&P.Kannaiah,EngineeringDrawing,3/e,ScitechPublishers,2012.
Reference Books	4. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, 2009. 5. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009. 6. K. Venugopal, Engineering Drawing and Graphics, 6/e, New Age Publishers, 2011. 7. K.C. John, Engineering Graphics, 2/e, PHI, 2013. 8. Basant Agarwal and C.M. Agarwal, Engineering Drawing, Tata McGraw Hill, 2008.
e-Resources& other digital material	1. http://www.youtube.com/watch?v=XCWJ_XrkWco, Accessed On 01-06-2017. 2. http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html# isodrawing, Accessed On 01-06-2017. 3. http://www.slideshare.net, Accessed On 01-06-2017. 3. http://edpstuff.blogspot.in, Accessed On 01-06-2017.

19HS1251- COMMUNICATIVE ENGLISH – II LAB

Course Category:	Humanities and SocialSciences		Credits:	1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-3
Prerequisites:	Nil		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Understand**thepurposeofapresentationandlearnstrategiestopresentthetext.	K2
CO2	**Comprehend**talks/lecturesandanswerinferentialquestionsusingPPTs/audio-visual aids	K2
CO3	**Analyze**the comprehensiveabilityandlogicalthinkingforbetterlisteningand speaking.	K4
CO4	**Facilitate**activelisteningtoenableinferentiallearningthroughexpertlecturesandtalks andteamupwithacolleaguetoparticipatewellinroleplays.	K3
CO5	**Develop**advancedlisteningskillsforanin-depthunderstandingofcomplextextsand collaboratewithapartnerforeffective performanceinmockinterviews	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

Experiment No.1	Listeningforpresentationstrategiesandansweringquestionsonthe speaker,audience,andkeypoints	CO1
Experiment No.2	FormalpresentationsusingPPTslides(individual)	
Experiment No.3	Relatingareadingtexttoatalk/presentation–understandingdifferent perspectivesanddrawinginferences	CO2
Experiment No.4	FormalteampresentationsusingPPTslides/audio-visual aids	
Experiment No.5	Identifyingviewsandopinionsexpressedbydifferentspeakerswhile listeningto discussions	CO3
Experiment No.6	Group discussion on general topics	
Experiment No.7	Processing of information using context clues while listeningto talks/lectures	CO4
Experiment No.8	Roleplays –peoplefrom variousfieldsof work	
Experiment No.9	Processingofexplicitinformationpresentedinthetextandimplicit informationinferable from the text or from previous/background knowledge	CO5
Experiment No.10	Mockinterviewsforjobs/internships	

Learning Resources

Reference Books	1. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018. 2. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.

	3. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012
e-Resources& other digital material	Grammar/Listening/Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Listening https://learningenglish.voanews.com/z/3613; http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/BBC; Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises All Skills https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org/ Online Dictionaries Cambridge dictionary online; MacMillan dictionary; Oxford learner's dictionaries

19BS1252-APPLIED PHYSICS LAB

Course Category:		Basic Sciences		Credits:		1.5	
Course Type:		Laboratory		Lecture-Tutorial-Practical:		0-0-3	
Prerequisites:		Nil		Continuous Evaluation:		25	
				Semester End Evaluation:		50	
				Total Marks:		75	

Course Outcomes

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

CO1	**Determine**therigiditymodulus,Poisson'sratioofamaterialandcoefficientof damping,qualityfactor foran oscillator.	K3
CO2	**Demonstrate**elasticlimitandstress-strainrelationshipusingHooke'slaw	K2
CO3	**Calculate**thermalconductivityofbad and goodconductors.	K3
CO4	**Apply**resonancetoestimatethefrequencyofatuning forkand**examine**therelation betweenfrequencyandvolumeofa cavity.	K3
CO5	**Identify**thetypeofsemiconductorand**evaluate**theacceptanceangle,numerical apertureanopticalfiber.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3										3	
CO2	3		3										3	
CO3	3		3										3	
CO4	3		3										3	
CO5	3		3										3	
Avg.	3		3										3	

1- Low	2-Medium	3-High

Course Content

Experiment No.1	ToDeterminetheRigidityModulusOfMaterialOfAWire-Dynamic Method(TorsionalPendulum).	CO1
Experiment No.2	ToDeterminethePoisson's RatioOfRubber Experiment	
Experiment No.3	To Investigate Hooke's Law	CO2
Experiment No.4	FormalteampresentationsusingPPTslides/audio-visual aids	CO3
Experiment No.5	ToStudyofResonanceinALCR Circuit.	CO4
Experiment No.6	ToVerifytheRelationBetweenVolumeofTheAirinTheResonator andFrequencyOfNote.	
Experiment No.7	ToDeterminetheResonanceFrequencyUsingSonameter	
Experiment No.8	ToDeterminetheFrequencyOfElectricallyMaintainedTuningForkBy Melde'sMethod.	
Experiment No.9	ToDeterminetheHallCoefficientUsingHallEffectExperiment.	CO5
Experiment No.10	ToDeterminetheNumericalApertureOfAGivenOpticalFibreand HenceToFindItsAcceptanceAngle.	

Learning Resources

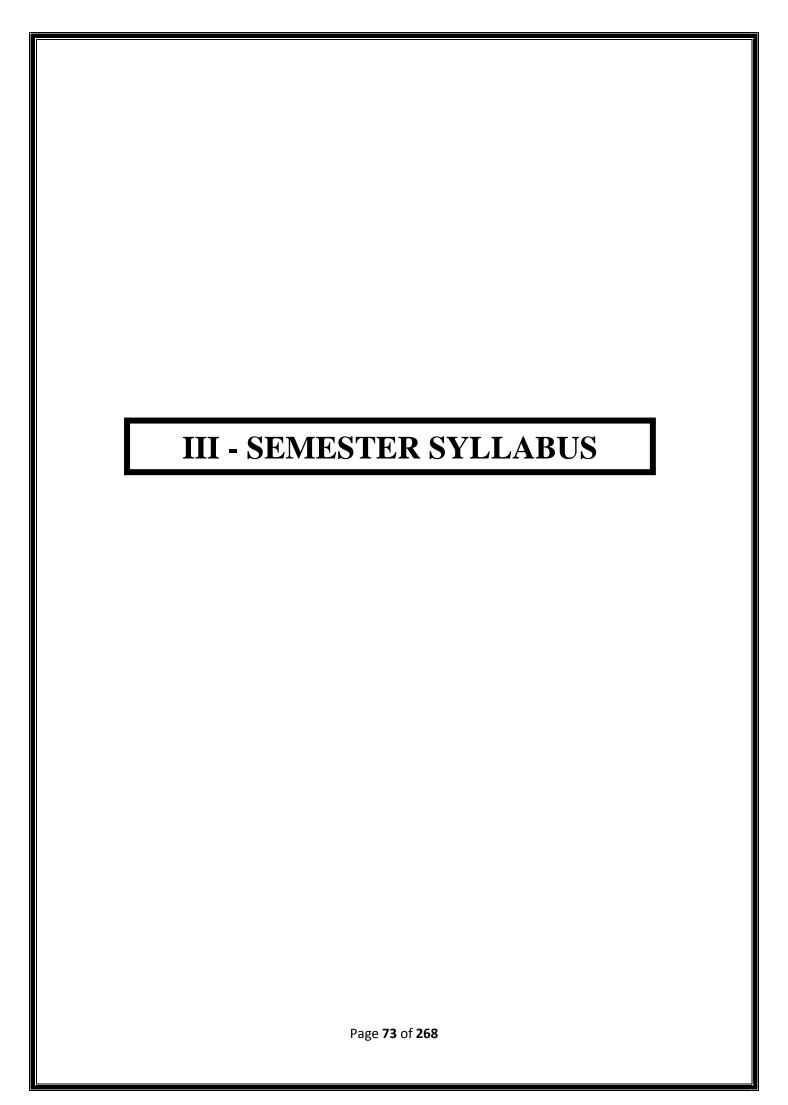| Text Books	1. RamaraoSri,ChoudaryNityanandandPrasadDaruka,"LabManualof Engineering Physics".,Vthed.,ExcellBooks,2010
Reference Books	1. PrithwirajPurkait,BudhadityaBiswas and ChiranjibKoley,Chapter11 Sensors and Transducers,ElectricalandElectronicsMeasurementsandInstrumentation,1/e., 2013 McGrawHillEducation(India)PrivateLimited,2013.
e-Resources& other digital material	1. http://www.physicsclassroom.com/The-Laboratory

19ES1251-BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

Course Category:	Engineering Sciences		Credits:		1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:		0-0-3
Prerequisites:	Nil		Continuous Evaluation:		25
			Semester End Evaluation:		50
			Total Marks:		75

Course Outcomes

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

CO1	**Familiarize** the basic DC and AC networks used in electrical and electronic circuits.	K2
CO2	**Explain** the concepts of electrical machines and their characteristics.	K2
CO3	**Identify** the importance of transformers in transmission and distribution of electric power.	K2
CO4	**Impart** the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).	K2
CO5	**Expose** basic concepts and applications of operational amplifier and configurations	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Verification of Kirchhoff's Laws KVL and KCL.	CO1
Experiment No.2	Verification of DC Superposition Theorem.	
Experiment No.3	Verification of Thevenin's Theorem and Norton's Theorem	
Experiment No.4	Swinburne's tests on a DC shunt motor.	CO2
Experiment No.5	OC and SC Tests on single phase transformer.	CO3
Experiment No.6	Brake Test on DC shunt motor.	CO4
Experiment No.7	Current Voltage Characteristics of a p-n Junction Diode/LED	
Experiment No.8	Diode Rectifier Circuits.	
Experiment No.9	Voltage Regulation with Zener Diodes.	CO5

Learning Resources

Text Books	1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1st edition, McGraw Hill Education (India) Private Limited, 2017. 2. B.L.Theraja, Fundamentals of Electrical Engineering and Electronics, 1st edition, S.Chand Publishing, New Delhi, 2006. 3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, Oxford University Press, 2014.
Reference Books	1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education, 2011. 2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008. 3. R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012

19CE3251-CIVIL ENGINEERING WORKSHOP

Course Category:	Program Core		Credits:	1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-3
Prerequisites:	Nil		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Understand** the market scenario of various building materials	K2
CO2	**Cast** and **test** the fly ash bricks and construct a brick wall	K3
CO3	**Plaster** a given brick surface, **paint** it and Lay tiles for flooring	K3
CO4	**Assemble** a pipeline joints, construct the recharge pit	K3
CO5	**Mark** a line diagram of a building by using chain/tape and other accessories and develop the model of various structures	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

Experiment No.1	**Market survey**: For trade/Commercial names, specifications, units of purchase of various types of cements, stones, bricks, flooring tiles, paints, roofing, Sanitary ware pipes, water closets, timber- plywood, hard board, block board etc.	CO1
Experiment No.2	1. Casting and testing of **fly ash bricks** 2. Assemble a brick wall using **English bond** without using mortar 3. Assemble a brick wall using **Flemish bond** without using mortar	CO2
Experiment No.3	1. **Plastering and finishing** of the wall 2. Application of **wall putty and painting** a wall 3. Application of **base coat and laying** of tile flooring of 1 sqm	CO3
Experiment No.4	1. Installation of **plumbing and fixtures** like tap, T-joint, Elbow, bend, Threading 2. Construction of a **Recharge pit**	CO4
Experiment No.5	1. Setting out a building: The student should set out a building (single bhk) as per the given plan using **chain** and other accessories 2. Setting out a building: The student should set out a building (single bhk) as per the given plan using **tape** and other accessories 3. **Model making** of different structures like building, bridges and different types of trusses	CO5

Learning Resources

Text Books	1. Rangawala, Engineering Materials: Materials Science, Charotor Publishing house, 2017

	2. B.C.Punmia,Ashok.K.Jain,Arun,K.Jain,BuildingConstruction,11/eLaxmiPublications
Reference Books	4. Mimi Das Saika, Bhargab Mohan Das, Madan Mohan Das, Elements of Civil Engineering, 1/e, PHI Learning PrivateLimited,2011 5. P.C. Varghese, A text Book Building Materials, 1/e, Prentice- Hall Publication,2005 6. Dala. K,R, Essentials of Civil Engineering, Charotar Publishing House
e-Resources&otherdigital material	1. http://www.constructionnews.co.in 2. https://nptel.ac.in/courses/105102088/ 3. https://theconstructor.org/videos/

III - SEMESTER SYLLABUS

19BS1301– ENGINEERING MATHEMATICS-III

Course Category:	Basic Sciences		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Determine** Laplace transform and inverse Laplace transforms of given function(s).	K3
CO2	**Develop** a Fourier series in terms of sine and cosine of a given function.	K6
CO3	**Find** out Fourier sine and cosine transforms.	K3
CO4	**Determine** complex potential function, evaluate integrals by applying Cauchy's integral formula and construct series expansions of complex functions.	K3
CO5	**Apply** method of separation of variables to find the solution of wave, heat, Laplace equations with given boundary conditions.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

Course Content

UNIT-1	**Laplace Transforms & Inverse Laplace Transforms** Definition of Laplace transform, properties of Laplace transform, transforms of derivatives, transforms of integrals, multiplication by t^n, division by t, unit step function, unit impulse function. Inverse Laplace transforms by partial fractions, convolution theorem (All theorems/properties without proofs)	CO1
UNIT-2	**Fourier Series** Fourier series, Dirichlet's conditions, functions of any period, odd and even functions - half range series. (All theorems/properties without proofs)	CO2
UNIT-3	**Fourier Transforms** Fourier integrals, Fourier cosine and sine integrals, Fourier transform, sine and cosine transform. (All theorems/properties without proofs)	CO3
UNIT-4	**Complex Variables** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate. Cauchy theorem, Cauchy integral formula, Taylor's series, Laurent's series. (All theorems/properties without proofs)	CO4
UNIT-5	**Applications of Partial Differential Equations** Classification of second order partial differential equations, method of separation of variables, solutions of one-dimensional wave equation, one dimensional heat equation and two-dimensional Laplace's equation in cartesian coordinates. (All theorems/properties without proofs)	CO5

Learning Resources

Text Books	1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44/e, 2019. 2. Erwin Kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.	
Reference Books	1. N.P. Bali and Manish Goyal, A Text book of Engineering Mathematics, Publications, 2008.	Laxmi
e-Resources& other digital material	1. https://www.nptel.ac.in/courses/111/105/111105123/ 2. https://www.nptel.ac.in/courses/111/105/111105134/ 3. https://www.nptel.ac.in/courses/111/105/111105093/	

19BS1303– LIFE SCIENCES FOR ENGINEERS

Course Category:	Basic Sciences		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Determine** Laplace transform and inverse Laplace transforms of given function(s).	K3
CO2	**Develop** a Fourier series in terms of sine and cosine of a given function.	K6
CO3	**Find** out Fourier sine and cosine transforms.	K3
CO4	**Determine** complex potential function, evaluate integrals by applying Cauchy's integral formula and construct series expansions of complex functions.	K3
CO5	**Apply** method of separation of variables to find the solution of wave, heat, Laplace equations with given boundary conditions.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

Course Content

UNIT-1	**Introduction to Biology** Comparison of Biological organisms with manmade systems- eye and camera, flying bird and aircraft. Classificationoflivingorganisms- Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources	CO1 CO3 CO5
UNIT-2	**Bio-molecules** Structureandfunctionsofproteinsandnucleicacids,hemoglobin,antibodies. Enzymes- Industrial applications, Fermentation and its industrial applications.	CO1 CO2
UNIT-3	**Bioenergetics and Respiration** Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Mechanism of photosynthesis. Human physiology.	CO2 CO3
UNIT-4	**Genetic Engineering** Mendel'slaws,genemapping,MitosisandMeiosis,Epistasis,singlegenedisordersinhumans.Genetic code.	CO2 CO4 CO5
UNIT-5	**Recombinant DNA Technology** Recombinant vaccines, transgenic microbes, plants and animals. Animal cloning, biosensors, biochips.	CO1 CO4 CO5

Learning Resources

Text Books	1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd,2018. 2. Arthur T Johnson, Biology for Engineers, CRC press,2011.
Reference Books	1. Alberts et al., The molecular biology of the cell, 6/e, Garland Science,2014. 2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wileyand Sons, 2009. 3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e,2012.

19ES1302- DESIGN THINKING

Course Category:	Engineering Sciences								Credits:		2	
Course Type:	Theory								Lecture-Tutorial-Practical:		2-0-0	
Prerequisites:	Nil								Continuous Evaluation:		30	
									Semester End Evaluation:		70	
									Total Marks:		100	

Course Outcomes

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

CO1	**Explain** the principles of design thinking and its approaches	K2
CO2	**Identify** the empathy, define phases in human centred design problems	K1
CO3	**Understand** the idea generation, prototype and testing in design thinking context	K2
CO4	**Apply** design thinking techniques for product innovation	K3
CO5	**Use** design thinking in business process models	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

Course Content

UNIT-1	**INTRODUCTION TO DESIGN THINKING:** An insight into Design, origin of Design thinking, Design thinking Vs Engineering thinking, importance of Design thinking, Design Vs Design thinking, understanding Design thinking and its process models, application of Design thinking	CO1
UNIT-2	**EMPATHIZE IN DESIGN THINKING:** Human-Centred Design (HCD) process - Empathize, Define, Ideate, Prototype and Test and Iterate. Role of Empathy in design thinking, methods and tools of empathy, understanding empathy tools. Explore define phase state users' needs and problems using empathy methods	CO2
UNIT-3	**IDEATION, PROTOTYPING AND TESTING :** Ideation methods, brain storming, advantages of brain storming, methods and tools of ideations, prototyping and methods of prototyping, user testing methods, Advantages and disadvantages of user Testing/ Validation	CO3
UNIT-4	**PRODUCT INNOVATION:** Design thinking for strategic innovation , Definition of innovation, art of innovation, teams for innovation, materials and innovation in materials, definition of product and its classification. Innovation towards product design Case studies	CO4
UNIT-5	**DESIGN THINKING IN BUSINESS PROCESSES:** Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs.	CO5

Learning Resources

Text Books	1. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley &

	Sons (2013).
	2. "Change by design", Tim Brown, Harper Collins, 2009
	3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan
	4. Engineering design by George E Dieter
Reference Books	1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization by Vijay Kumar
	2. Human-Centered Design Toolkit: An Open-Source Toolkit To Inspire New Solutions in the Developing World by IDEO
e- Resources & other digital material	1. https://www.interaction-desiqn.ora/literature/topics/desiqn-th/nkinq
	2. https://www.interaction-desiqn.prq/literature/article/how-tq-<eve'op-an-empath\capproach-in-design-thinking

19CE3301– ENGINEERING MECHANICS

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19BS1101-Engineering Mathematics I (Calculus and Algebra)		Continuous Evaluation:		30
	19BS1201-Engineering Mathematics II (ODE, PDE and Multivariable Calculus)		Semester End Evaluation:		70
	19BS1204-Applied Physics		Total Marks:		100

Course Outcomes

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

CO1	**Draw** the free body diagram of a given physical system and **compute** the resultant of a given coplanar system of forces	K3
CO2	**Estimate** the centroid of composite areas, bodies, area moment of inertia and mass moment of inertia of bodies	K5
CO3	**Explain** concepts of friction and **solve** the problems involving the friction	K3
CO4	**Analyse** plane truss (frame) by method of joints and method of sections	K4
CO5	**Analyse** the dynamics of particles both in rectilinear and curvilinear motion.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

Course Content

UNIT-1	**SYSTEM OF FORCES-EQUILIBRIUM OF SYSTEM OF FORCES** Types of Force Systems-Coplanar Concurrent and Non concurrent Forces–Resultant–Moment of a Force and its application– Couples and Resultant of a Force System, resolution of a force into a force and a couple, Polygon law of forces for resultant. Free body diagrams, equations of equilibrium of coplanar concurrent and non-concurrent force systems, Lami's theorem.	CO1
UNIT-2	**PROPERTIES OF SURFACES AND SOLIDS** Determination of Areas - First moment of Area and the centroid – centroid of simple figures by integration –circular arc, Quarter circular arc, semi-circular arc, triangle, semi-circle, quarter circular area, sector of circle, general spandrel, simple problems involving composite figures. Second moment of plane area - Parallel axis theorems and perpendicular axis theorems - Polar moment of Inertia - Second moment of area of simple figures- Rectangle, Triangle, Circle, Semi-circle, quarter circle. Second moment of plane area of sections like C, I, T, Z etc. - Basic Concept of Mass moment of Inertia.	CO2
UNIT-3	**FRICTION AND ITS APPLICATION** **Friction:** Types of friction, Laws of dry Friction, limiting friction, Cone of Friction, Concept of Static and Dynamic Friction; Numerical problems on motion of single and connected bodies on planes, wedge friction, ladder friction.	CO3
UNIT-4	**ANALYSIS OF PERFECT FRAMES (ANALYTICAL METHOD)** Types of Frames-Assumptions for forces in members of a perfect frame, Method of joints, Cantilever Trusses, Structures with one end hinged and the other freely supported on rollers (Not more than 6 members), Method of sections (Not more than 3 members).	CO4
UNIT-5	**DYNAMICS OF PARTICLES**	CO5

Displacements, Velocity and acceleration, their relationship in rectilinear motion, Curvilinear motion in rectangular coordinates, normal and tangential coordinates, projectile motion, Newton's law, D'Alembert's Principle.

Learning Resources

Text Books	1. A. K. Tayal, Engineering Mechanics (Statics and Dynamics), Umesh Publications, 14th Edition, 2011. 3. N.H.Dubey, Engineering Mechanics(Statics and Dynamics), McGraw Hill Education (India) Private Limited, 2016.
Reference Books	1. S. Timoshenko & D. H. Young, and JV Rao, Engineering Mechanics, 4th Ed., TMH Education, 2006. 4. K. Vijay Kumar Reddy, J. Suresh Kumar, Singer's Engineering Mechanics Statics and Dynamics, BS Publications, 3rd Edition, 2011.
e- Resources & other digital material	1. http://nptel.ac.in/courses.php 3. http://jntuk-coeerd.in/

19CE3302– FLUID MECHANICS

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19BS1101-Engineering Mathematics I (Calculus and Algebra)		Continuous Evaluation:		30
	19BS1201-Engineering Mathematics II (ODE, PDE and Multivariable Calculus)		Semester End Evaluation:		70
	19BS1204-Applied Physics		Total Marks:		100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Determine** the fluid pressure and use various devices for measuring fluid pressure.	K3
CO2	**Calculate** hydrostatic force and use of law of conservation mass to fluid flow.	K3
CO3	**Apply** Bernoulli's equation to fluid flow problems and boundary layer theory to determine lift and drag forces on a submerged body.	K3
CO4	**Apply** appropriate equations and principles to analyze pipe flow problems.	K3
CO5	**Use** of different fluid flow measuring devices.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

Course Content

UNIT-1	**INTRODUCTION:** Dimensions and units – Physical properties of fluids specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion. Pressure at a point, Pascal's law, Hydrostatic law - atmospheric, gauge and vacuum pressure- measurement of pressure. Pressure gauges, Manometers: differential and Micro Manometers.	**CO1**
UNIT-2	**HYDROSTATIC FORCES:** Hydrostatic forces on submerged plane, horizontal, vertical, inclined, and curved surfaces Total pressure and centre of pressure derivations and problems. **FLUID KINEMATICS-** Description of fluid**,** stream line, path line and streak lines and stream tube. Classification of flows- steady, unsteady, uniform non-uniform, laminar, turbulent, rotational, irrotational flows, Equation of continuity for one, two, three dimensional flows- stream and velocity potential functions, flow net analysis	**CO2**
UNIT-3	**FLUID DYNAMICS:** Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line for 3-D flow, Navier–stokes equations, Momentum equation and its application – forces on pipe bend. Boundary layer – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Separation of boundary layer, Flow around submerged objects- drag and lift- Magnus effect**.**	**CO3**
UNIT-4	**LAMINAR FLOW:** Reynold's experiment- Characteristics of laminar and turbulent flows. Flow between parallel plates, flow through long tubes. **FLOW THROUGH PIPES –** Laws of fluid friction – Darcy's equation, minor losses Pipes in series- pipes in parallel- total energy line and hydraulic gradient line. variation of friction factor with Reynold's number- Moody' chart**.**	**CO4**
UNIT-5	**MEASUREMENT OF FLOW:** Pitot tube, Venturi meter and orifice meter. Classification of orifices, Flow over rectangular, triangular, trapezoidal and	**CO5**

	stepped notches, Broad crested weirs	
Learning Resources		
Text Books	1. P.N. Modi and S.M. Seth, Fluid Mechanics (18th edition) Standard Book House,2017. 2. A.K. Jain, Fluid Mechanics, Khanna publishers,2010. 3. A text book of Fluid Mechanics and Hydraulic Machines (7th edition) Laxmi publications(P) ltd; New Delhi, 2000	
Reference Books	1. L. Victor, Streeter and E. Benjamin Wylie, Fluid Mechanics, Tata McGraw Hill,1985. 2. M. Franck White, Fluid Mechanics, Tata McGraw Hill,2017. 3. K. Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill,2001. 4. A text book of Fluid Mechanics and Hydraulic Machines by R. K. Rajput, S. chand Technical	
e- Resources & other digital material	1. Fluid Mechanics virtual labs. http://eerc03-iiith.vlabs.ac.in/ 2. https://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm 4. https://nptel.ac.in/courses/105105119.	

19CE3303– SURVEYING

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19BS1101-Engineering Mathematics I (Calculus and Algebra)		Continuous Evaluation:		30
	19BS1201-Engineering Mathematics II (ODE, PDE and Multivariable Calculus)		Semester End Evaluation:		70
	19BS1204-Applied Physics		Total Marks:		100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Comprehend** the principles of chain, compass and distance	K2
CO2	**Comprehend** the principles of plane table, Analyze levelling and contouring	K2
CO3	**Understand** the principles of Theodolite and Tachometric Surveying	K2
CO4	**Set**out curves and **computation** of Areas and Volumes	K3
CO5	**Know** the Principles of triangulation survey and make **use** of advanced instruments	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

Course Content

UNIT-1	**Chain Surveying:** Surveying objectives, linear measurements, instruments for surveying, preparation of map and plan, measurement of distance, chain surveying principles, offsets, chain surveying instruments, traverses with a chain, problems on obstacles of chain surveying. **Compass Surveying:** Types of compass, meridians and bearings, local attraction, magnetic declination, measurement of directions and angles traversing with a compass, plotting of traverse, adjustment of closing error.	CO1
UNIT-2	**Plane Table Surveying:** Principle and instruments used in plane table surveying, working operations, methods of plane table surveying. **Levelling and Contouring:** Instruments for levelling, principle and classification of levelling, bench marks, height (level) computations, longitudinal and cross-sectional levelling, problems on levelling. Contours, characteristics of contours, contours of natural features, methods of contouring.	CO2
UNIT-3	**Theodolite Surveying:** Theodolite component parts, classification, theodolite observations, principle of theodolite survey, traverse computations, practical problems. **Tacheometric Surveying:** Principle of tacheometry, methods of tacheometry, tacheometry as applied to subtense measurement, field work for tacheometric surveying, errors.	CO3
UNIT-4	**Curve Setting:** Types of curves, elements of a curve, setting out a simple curve, setting out a compound curve, reverse curve, transition curves. **Construction Surveys:** Setting out of buildings, computation of areas, earthwork measurements: LS&CS,	CO4

	computation of volumes.	
UNIT-5	**Triangulation Surveying:** Base of the object accessible, base of an inclined object accessible, reduced level of the elevated points with inaccessible bases, instrument axes at different levels, principle of triangulation, purpose and classification of triangulation surveys, layout of triangulation. **Total Station & GIS:** EDM instruments, Total Station, Global Positioning System, GIS	**CO5**

Learning Resources

Text Books	1. B.C. Punmia, A.K. Jain, Arun Jain, Surveying I and II, 16/e, Lakshmi Publications, 2017. 2. R. Subramanian, Surveying and Levelling, 2/e, Oxford University Press,2014. 3. D.G Charles, R.W. Paul, Elementary Surveying: An Introduction to Geomatics, 15/e, Prentice Hall,2018
Reference Books	1. S.K. Roy, Fundamentals of Surveying, 2/e, Prentice Hall of India, 2011. 2. T.P. Kanetkar, Surveying and Levelling, Part I and II, 4/e, New Central Book Agency2012.
e- Resources & other digital material	1. https://nptel.ac.in/courses/105107122/ 2. http://jntuk-coeerd.in/

19MC1301– ENVIRONMENTAL SCIENCE

Course Category:	Mandatory Course		Credits:	0
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	100
			Semester End Evaluation:	-
			Total Marks:	100

Course Outcomes

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

CO1	**Develop** an awareness and knowledge on natural resource protection.	K6
CO2	**Compile** for the better future of environment in India which is based on many positive factors like Biodiversity and ecosystems.	K3
CO3	**Apply** knowledge how to manage the harmful pollutants	K3
CO4	**Identify** solutions for global environmental problems for sustainable environment.	K1
CO5	**Create** awareness among the youth on environmental acts; take part in Environment impact assessment and management plans.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

Course Content

UNIT-1	**INTRODUCTION TO ENVIRONMENT AND NATURAL RESOURCES** Introduction to environment: Definition scope importance need for public awareness. Natural resources: Renewable and non-renewable resources, natural resources and associated problems. Forest resources: Uses, Reasons for over-exploitation, deforestation effects case studies. Water resources: Use and over – utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. Mineral resources: Uses, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, Impacts of overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, use of renewable and non-renewable energy sources, case studies.	CO1
UNIT-2	**ECOSYSTEMS AND BIODIVERSITY** Structure components of ecosystem: Biotic and Abiotic components. Functional components of an ecosystem: Food chains, Food webs, Ecological pyramids, Energy flow in the ecosystem, Ecological succession. Biogeochemical cycle: Nitrogen, carbon, Phosphorus cycle. Biodiversity: Definition, Levels of biodiversity: genetic, species and ecosystem diversity. Bio-geographical classification of India, Values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega – diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In– situ and Ex-situ conservation of biodiversity.	CO2
UNIT-3	**ENVIRONMENTAL POLLUTION AND CONTROL**	CO3

	Environmental Pollution: Definition, causes, effects and control measures: Air Pollution, Water pollution, Soil pollution, Marine pollution, Thermal pollution, nuclear hazards, Solid waste Management, e-waste, Pollution case studies.	
UNIT-4	**SOCIAL ISSUES AND GLOBAL ENVIRONMENT PROBLEMS AND EFFORTS** From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management, Remote sensing and GIS methods. Environmental ethics: Issues and possible solutions. Green building concept, Environmental Impact Assessment Environmental Management Plan, Climate change: global warming, acid rain, ozone layer depletion.	**CO4**
UNIT-5	**HUMAN POPULATION AND ENVIRONMENT LEGISLATION** Population growth, Environment and human health. HIV/AIDS,. Value Education. Women and Child Welfare. Role of Information Technology in Environment and human health. Environment Legislation. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Environmental Protection Act.	**CO5**

Learning Resources

Text Books	1. Anubha Kaushik and C.P. Kaushik, Text book of environmental studies New Age International Publisher (2014). 2. ErachBarucha, Text book of environmental studies for undergraduates courses, published by – University Grants Commission, University Press (2005) AninditaBasak, Environmental Studies. Pearson (2009)
Reference Books	1. D.K. Asthana and Meera Asthana, A Text book of Environmental Studies, S. Chand (2010). 2. P.M Cherry Solid and Hazardous waste Management, CBS Publisher (2016). 3. Charles H. Ecclestion, Environmental Impact Assessment, CRC Press (2011).

19BS1351– LIFE SCIENCES FOR ENGINEERS LAB

Course Category:	Basic Science Course		Credits:	1
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-2
Prerequisites:	Nil		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Understand** basic facts and concepts in life sciences.	K2
CO2	**Evaluate** and explain different processes in industrial applications	K5
CO3	**Summarize** the applications of various spheres in life sciences in relevance to future studies	K5
CO4	**Develop** the ability to apply the principles of Mendalian laws and acquire problem solving skills.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								2					
CO2	3								2					
CO3	3								2					
CO4	3								2					
Avg.	3								2					

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Microscopy	CO1, CO3
Experiment No.2	Dissect & mount different parts of plants using Microscope	CO1, CO3
Experiment No.3	Estimation of Proteins by using Biuret method	CO1, CO2
Experiment No.4	Estimation of enzyme activity.	CO1, CO2
Experiment No.5	Estimation of chlorophyll content in some selected plants.	CO1, CO3
Experiment No.6	Nitrogen Cycle: Estimation of Nitrates /Nitrites in soil by using Spectrophotometer	CO2,CO3
Experiment No.7	Mendal's laws	CO1, CO4
Experiment No.8	Microscopy	CO1, CO3

19ES1352- DESIGN THINKING LAB

Course Category:	Engineering Sciences		Credits:	1
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-2
Prerequisites:	Nil		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Develop** a mind map for design thinking process	K6
CO2	**Prepare** empathy maps and journey maps for problems.	K3
CO3	**Construct** mock-up models through ideation and innovation techniques	K6
CO4	**Use** software for design thinking problems	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			2	2					3					2
CO2			2	2					3					2
CO3			2	2					3					2
CO4			2	2					3					2
Avg.			2	2					3					2

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Design a mind map of design thinking	CO1
Experiment No.2	Thirty circle Exercise ---ideation	CO3
Experiment No.3	Prepared a toothpick bridge (mock-up model)	CO1,CO3
Experiment No.4	Prepared a marble maze (mock up model)	CO1,CO3
Experiment No.5	Build a wind power car (mock up model)	CO1,CO3
Experiment No.6	Make a hydraulic elevator (mock up models)	CO1,CO3
Experiment No.7	Construct empathy maps for a given case study-1	CO2
Experiment No.8	Develop customer journey map for a given case	CO2
Experiment No.9	Construct empathy maps for a given case study-2	CO2
Experiment No.10	Develop customer journey map for a given case -2	CO2
Experiment No.11	Make a paper prototype for user testing (mock-up model)	CO2
Experiment No.12	Design and development of cell phone wallet (mock-up model)	C01,C02,C03
Experiment No.13	Design thinking using sprint base software	CO4
Experiment No.14	Design thinking using sprint base software	CO4

Learning Resources

Text Books	4. Idris Mootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013). 5. "Change by design", Tim Brown, Harper Collins, 2009 6. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil service Commission, Bhutan Engineering design by George E Dieter
Reference Books	1. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization by Vijay Kumar 2. Human-Centered Design Toolkit: An Open-Source Toolkit To Inspire New Solutions in the Developing World by IDEO
e-Resources& other digital material	1. https://www.interaction-desiqn.ora/literature/topics/desiqn-th/nkinq 2. https://www.interaction-desiqn.prq/literature/article/how-tq-<eve'op-an-empath\capproach-in-design-thinking

Course Category:	Program Core			Credits:		1.5	
Course Type:	Laboratory			Lecture-Tutorial-Practical:		0-0-3	
Prerequisites:	19BS1101-Engineering Mathematics I (Calculus and Algebra)			Continuous Evaluation:		25	
	19BS1201-Engineering Mathematics II (ODE, PDE and Multivariable Calculus)			Semester End Evaluation:		50	
	19BS1204-Applied Physics			Total Marks:		75	

Course Outcomes

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

CO1	**Determine** the discharge through pipes by using venturi meter and orifice meter, determine the discharge from tanks by using small orifice at constant head and mouth piece at varying head	K3
CO2	**Understand** the Bernoulli's equation and its **application** and energy dissipation in hydraulic jump	K3
CO3	**Calculate** loss of head in pipes due to friction and minor energy losses	K3
CO4	**Gain** knowledge about the efficiency of the turbines	K2
CO5	**Gain** knowledge about the efficiency of the pumps	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Calibration of Venturi-meter & Orifice meter	
Experiment No.2	Determination of Coefficient of discharge for a small orifice by a constant head method	CO1
Experiment No.3	Determination of Coefficient of discharge for a mouth piece by variable headmethod	
Experiment No.4	Calibration of Triangular Notch /Rectangular Notch	
Experiment No.5	Verification of Bernoulli's equation.	CO2
Experiment No.6	Study of Hydraulic jump	
Experiment No.7	Determination of coefficient of discharge for Rectangular Weir	
Experiment No.8	Determination of Coefficient of loss of head in a sudden contraction and friction factor.	CO3
Experiment No.9	Demo on performance test on Pelton wheel turbine	CO4
Experiment No.10	Demo on performance test on Francis turbine.	
Experiment No.11	Study of efficiency test on centrifugal pump.	CO5
Experiment No.12	Study of efficiency test on reciprocating pump	

Learning Resources

Laboratory Manuals	1. Laboratory Manuals available in FM Laboratory.
	2. Sarbjit Singh, Experiments in Fluid Mechanics, Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2012.
	3. V.P. Gupta J. Chadra and K.S. Gupta, Laboratory Manual of Fluid

	Mechanics and Machines, CBS Publishers and Distributors, New Delhi,2006.
Reference Standards	1. To determine the coefficient of discharge of Venturi-meter and Orifice-meter. (IS 1465 (Part 1) : 1999 (2004), IS0 5167-1 : 1991 – Measurement of Fluid Flow by Means of Pressure Differential Devices, Part 1: Orifice Plates, Nozzles and Venturi Tubes Inserted in Circular cross-section conduits running full)
	2. To determine the coefficient of discharge of mouthpiece and small orifice by constant head and falling head methods.(IS 14615 (Part 1): 1999 (2004), IS0 5167-1: 1991 – Measurement of Fluid Flow by Means of Pressure Differential Devices, Part 1: Orifice Plates, Nozzles and Venturi Tubes Inserted in Circular cross-section conduits running full)
	3. To determine the coefficient of discharge of V-notch (triangular notch) &rectangular notch.(IS 9108 : 1979 (2003) – Liquid Flow Measurement in Open Channels using Thin Plate Weirs)(IS 13083: 1991(2003), IS0 4377: 1990- Liquid Flow Measurement in Open Channels - Flat-V Weirs)
	4. To compute the friction factor using Darcy-Weisbach Equation for pipes of different diameters.(IS 2595 (Part I): 1965 (Reaffirmed 2003) – Head loss in Straight Pipes due to frictional resistance.
	5. To study the performance characteristics of Pelton wheel turbine.(IS 12800 (Part 3) : 1991 (2003) - Guidelines for Selection of Hydraulic Turbine, Preliminary Dimensioning and Layout of Surface Hydroelectric Powerhouses, Part 3 - Small, Mini And Micro Hydroelectric Power Houses)
	6. To study the performance characteristics of the Francis turbine.(IS 12800 (Part 3) : 1991 (2003) - Guidelines for Selection of Hydraulic Turbine, Preliminary Dimensioning and Layout of Surface Hydroelectric Powerhouses, Part 3 - Small, Mini And Micro Hydroelectric Power Houses)
	7. To study the working principles of a centrifugal pump.(IS 9137: 1978 (1993) – Code for Acceptance Tests for Centrifugal, Mixed Flow and Axial Pumps - Class C)ISO 9905: 1994 - Technical specifications for centrifugal pumps — Class IOther codes: IS 9118: 1979 (2001) – Method for Measurement of Pressure by means of Manometers.

19CE3352- SURVEYING LAB

Course Category:	Program Core			Credits:		1.5
Course Type:	Laboratory			Lecture-Tutorial-Practical:		0-0-3
Prerequisites:	19BS1101-Engineering Mathematics I (Calculus and Algebra)			Continuous Evaluation:		25
				Semester End Evaluation:		50
				Total Marks:		75

Course Outcomes

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

CO1	**Use** of survey equipment's like chain, compass, plane table, dumpy level.	K3
CO2	**Survey** and plotting of an area, inaccessible points of an area with Compass.	K3
CO3	**Demonstrate** traversing, fly leveling and contouring.	K3
CO4	**Use** Total Station for field surveying to determine the distances, directions and elevations, height of the objects, area and boundaries of fields.	K3
CO5	**Set** out simple curves using Theodolite, Total Station, set out for building.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				3					3			3	3	
CO2				3					3			3	3	
CO3				3					3			3	3	
CO4				3					3			3	3	
CO5				3					3			3	3	
Avg.				3					3			3	3	

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Plotting Chaining across obstacles	
Experiment No.2	Determination of distance between two inaccessible points with compass	CO1
Experiment No.3	Area survey by using chain survey (closed traverse)	
Experiment No.4	Area survey by prismatic compass (closed traverse) and plotting after adjustment.	CO2
Experiment No.5	Radiation method by plane table survey	
Experiment No.6	Intersection method by plane table survey	
Experiment No.7	Heights and distance using Principles of tachometric surveying	
Experiment No.8	Fly leveling (differential leveling)	CO3
Experiment No.9	One exercises on contouring	
Experiment No.10	Determination of Distances, Directions and Elevations	CO4
Experiment No.11	Determination of Height of an object.	
Experiment No.12	Determination of Boundaries of a Field and computation of area.	
Experiment No.13	Setting out of simple curve using theodolite..	
Experiment No.14	Setting out of a simple curve using Total Station.	CO5
Experiment No.15	Setting out of Building	

Learning Resources

Laboratory Manuals & Text Books	1. Surveying Lab Manual by Dept. of CE, PVPSIT 2. B.C. Punmia, A.K. Jain, Arun Jain, Surveying I and II, 16/e, Laxmi Publications,2017. 3. R. Subramanian, Surveying and Levelling, 2/e, Oxford University

	Press,2014.
	4. D.G Charles, R.W. Paul, Elementary Surveying: An Introduction to Geomatics, 15/e, Prentice Hall,2018
Reference Books	1. S.K. Roy, Fundamentals of Surveying, 2/e, Prentice Hall of India, 2011.
	2. T.P. Kanetkar, Surveying and Levelling, Part I and II, 4/e, New Central Book Agency2012.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105107122/
	2. http://jntuk-coeerd.in/

IV - SEMESTER SYLLABUS

Course Category:	Basic Sciences		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Determine** approximate root of an equation and apply different methods to calculate the value of interpolating polynomial at given point	K3
CO2	**Evaluate** integrals making use of quadrature formulae and solve ordinary differential equations by Euler's, R.K. methods.	K5
CO3	**Use** discrete and continuous distribution models to calculate probabilities for appropriate random variables.	K3
CO4	**Understand** and **apply** the basic concepts of inferences concerning means and proportions to the decision-making process.	K3
CO5	**Interpret** hypotheses test for small samples.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

Course Content

UNIT-1	**Solution to Algebraic and Transcendental Equations** Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson's method. Finite differences, relation between operators, interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formula.	CO1
UNIT-2	**Numerical Differentiation and Integration** Numerical Differentiation-Newton's forward and backward difference formulae, numerical integration- trapezoidal rule, Simpson's $\frac{1}{3}^{rd}$ and $\frac{3}{8}^{th}$ rules. Ordinary differential equations: Euler's, modified Euler's, Runge-Kutta method of fourth order for solving first order equations.	CO2
UNIT-3	**Probability** Random variables (discrete and continuous), probability density functions, probability distribution: Binomial - Poisson - normal distribution and their properties (mathematical expectation and variance).	CO3
UNIT-4	**Testing of Hypothesis** Formulation of null hypothesis, critical regions, level of significance. Large sample tests: Test for single proportion, difference of proportions, test for single mean and difference of means.	CO4
UNIT-5	**Small Sample Tests** Student's t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test)	CO5

Learning Resources

Text Books	1. B.S. Grewal, *Higher Engineering Mathematics,* Khanna Publishers, 44/e, 2019. 2. T.K.V.Iyenger, Krishna Gandhi and others, *Probability & Statistics*, S.Chand.
Reference Books	5. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9/e, John Wiley & Sons, 2006. 6. Miller and Freund's, *Probability and Statistics for Engineers* , Pearson.
e-Resources& other digital material	1. https://www.nptel.ac.in/courses/111/107/111107105/ 2. https://www.nptel.ac.in/courses/111/105/111105041/ 3. https://www.nptel.ac.in/courses/111/106/111106112/ 4. https://www.nptel.ac.in/courses/111/105/111105090/

19ES1401 - AI TOOLS

Course Category:	Engineering Sciences		Credits:	2
Course Type:	Theory		Lecture-Tutorial-Practical:	2-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** the Fundamentals of Artificial Intelligence and its Applications.	K2
CO2	**Summarize** various machine learning methods.	K4
CO3	**Identify** different machine learning applications.	K1
CO4	**Compare** Machine Learning & Deep Learning and **Outline** basic Deep Learning Algorithm.	K4
CO5	**Make use of** Deep Learning Concepts for various Applications.	K3

	Contribution of Course Outcomes towards achievement of Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2												1	2
CO2	2	2											2	2
CO3	2	2		2									2	3
CO4	2	2											2	2
CO5	2	2	2	2		1						2	2	3
Avg.	**2**	**2**	**2**	**2**		**1**						**2**	**2**	**2**

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Introduction to Artificial Intelligence:** What is AI, Foundations of AI, Goals of AI, and Applications of AI.	CO1
UNIT-2	**Machine Learning: Definition, Learning Methods:** Supervised Learning, Unsupervised Learning, Semi-Supervised Learning, Reinforcement Learning.	CO2
UNIT-3	**Machine Learning Applications:** Computer vision, Speech Recognition, Natural Language Processing, Decision Making process.	CO3
UNIT-4	**Deep Learning:** Basics of Deep Learning, Machine Learning Vs Deep Learning, Fundamental Deep Learning Algorithm-Convolution Neural Network (CNN).	CO4
UNIT-5	**Deep Learning Applications:** Computer vision, Speech Recognition, Natural Language Processing, Decision Making process.	CO5

Learning Resources

Text Books	1. Artificial Intelligence: A Modern Approach Stuart Russell and Norvig, Pearson, 3rd Edition. **(Unit-1)** 2. Machine Learning A Probabilistic Perspective, Kevin P. Murphy, The MIT Press **(Unit-2&3)** 2. Deep Learning (Adaptive Computation and Machine Learning series), MIT Press, 2017. **(Unit-4&5)**
e-Resources& other digital material	**1.** https://swayam.gov.in/nd1_noc19_cs52/preview **2.** https://swayam.gov.in/nd1_noc19_cs85/preview https://emerj.com/ai-sector-overviews/machine-learning-healthcare-applications/

19CE3401 - MECHANICS OF SOLIDS

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3301- Engineering Mechanics		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Describe** the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships	K2
CO2	**Determine** shear force, bending moment of statically determinate beams and frames and draw SFD and BMD.	K3
CO3	**Analyze** various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress	K4
CO4	**Evaluate** the flexural stresses, section modulus for various sections and draw shear stress distribution for rectangular, circular, triangular, I, T and angle sections.	K5
CO5	**Apply** the torsion equation, calculate power transmitted by the shaft and determine the deflections of closed coiled helical springs.	K3

										Contribution of Course Outcomes towards achievement of Program Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3						1					3	2
CO2	2	3						1					3	2
CO3	2	3						1					3	2
CO4	2	3						1					3	2
CO5	2	3						1					3	2
Avg.	2	3						1					3	2

1- Low	2-Medium	3-High

Course Content

UNIT-1	**SIMPLE STRESSES AND ELASTIC CONSTANTS** Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity, types of stresses and strains, Hooke's law stress –strain diagram for mild steel working stress, factor of safety, Lateralstrain, Poisson's ratio and volumetric strain –Elastic moduli and the relationship between them; Bars of varying section, composite bars, temperature stresses.Relationship between elastic constants.Strain Energy –Resilience, Gradual, sudden, impact and shock loadings, simple applications.	CO1
UNIT-2	**BENDING MOMENT AND SHEAR FORCE DIAGRAMS** Relationship between moment, shear and load. Bending Moment (BM) and Shear Force (SF) diagrams. BM and SF diagrams for cantilevers, simply supported with or without overhangs. Calculation of maximum BM and SF and the point of contraflexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments	CO2
UNIT-3	**COMPLEX STRESSES** Stresses on inclined plane on block subjected to normal stress and shear stress along two planes at right angles, principal plane and principal stresses, Mohr's circle for finding principal stresses, Directions of principal planes, Volumetric strain.	CO3
UNIT-4	**STRESSES IN BEAMS**	CO4

	Derivation of bending equation, Neutral axis, determination of bending stresses, section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections, Design of simple beam sections. Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.	
UNIT-5	**TORSIONAL STRESSES IN SHAFTS** Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.	**CO5**

Learning Resources

Text Books	1. V.N Vazirani and M.M Ratwani, Analysis Of Structures Vol-I, Khanna Publishers, 2003. 2. S.Timoshenko, Strength Of Materials: Elementary Theory and Problems-Vol.I, 2004. 3. R.Subrahmanian, Strength of Materials, 3/e, Oxford University Press, 2016.
Reference Books	1. S.S. Rattan, Strength of Materials, 2/e, Tata McGraw Hill Education, 2011. 2. Gere and Timoshenko, Mechanics of Materials, 4/e, CBS Publishers, 2006. 3. Stephen Timoshenko, Strength of Materials, 3/e, CBS Publisher, 2002. 4. R.K. Rajput, Strength of Materials, S. Chand Publications, 2007
e-Resources& other digital material	1. http://nptel.ac.in/courses.php 2. http://jntuk-coeerd.in/

19CE3402 - ENVIRONMENTAL ENGINEERING

Course Category:	Program Core		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19BS1102-Chemistry of Materials 19MC1301-Environmental Sciences		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Know** the requirements of water and its sources.	K2
CO2	**Identify** various methods of water treatment.	K1
CO3	**Analyze** with concepts of water distribution.	K4
CO4	**Know** wastewater characteristics and wastewater treatment	K2
CO5	**Demonstrate** the use of different sewage appurtenances.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**WATER SOURCES, QUANTITY AND QUALITY**: Protected water supply – Population forecasts, design period – water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards – Waterborne diseases – Comparison from quality and quantity and other considerations – intakes – infiltration galleries.	CO1
UNIT-2	**WATER TREATMENT:** Sedimentation – principles of coagulation-flocculation, clarifier coagulants – Filtration – theory – working of slow and rapid gravity filters disinfection – theory of chlorination, chlorine demand, other disinfection practices- Miscellaneous treatment methods.	CO2
UNIT-3	**WATER DISTRIBUTION:** Distribution systems – Gravity system – Pumping system – Dual system – Layout distribution system– Dead End – Grid Iron – Radial systems – Analysis of Pipe networks – Hardy Cross and equivalent pipe, Simple problems. Sluice Valves – Pressure Relief Valves – Check walls – Meters	CO3
UNIT-4	**SEWAGE TREATMENT**: Characteristics of sewage – cycles of decay – decomposition of sewage, examination of sewage – B.O.D– C.O.D. equations. Introduction to primary and secondary treatment of waste water, sedimentation tanks biological treatment – trickling filters. Sludge digestion – design of Digestion tank.	CO4
UNIT-5	**SEWAGE TREATMENT (Contd.):** Sludge disposal by drying – septic tanks and Imhoff Tanks working principles and design – soak pits, Disposal of Sewage. **SEWAGE APPARTUNANCES:** Sewer appurtenance – inverted siphon – catch basins — sanitary fittings-traps – one pipe and two pipe systems of plumbing. Sewage pipe network	CO5

Learning Resources

Text Books	1. P.N.MODI, Water Supply Engineering, Vol-I, Standard Book House,2016 2. P.N.MODI, Sewage Treatment & Disposal & Waste Water Engg., Vol-II,

	Standard Book House,2015
Reference Books	1. B.C. Punmia, Ashok Jain & Arun Jain, Laxmi Publications Pvt. Ltd, NewDelhi,2010
	2. Elements of environmental engineering by K.N. Duggal, S. ChandPublishers,2008
e-Resources& other digital material	1. https://nptel.ac.in/courses/105104102/
	2. https://nptel.ac.in/courses/105105048/

19CE3403 - GEOTECHNICAL ENGINEERING

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3301- Engineering Mechanics		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** formation of soil and classification of soils by formation and transporting agent, Indian regional soil deposits	K2
CO2	**Determine** index properties of soil, coefficient of permeability and classify the soil as per IS soil classification	K3
CO3	**Evaluate** the effective stress and vertical stress distribution	K5
CO4	**Determine** compaction characteristics of soil and consolidation	K3
CO5	**Determine** shear strength analytically and from laboratory data and choose the relevant laboratory or field-testing method to evaluate shear strength.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Soil Properties:** Origin and formation of soils, General types of soils, residual and transported soils, three phase representation of soil mass, physical properties of soil – void ratio, porosity, degree of saturation, water content, module weights, specific gravity – their functional relationships, relative density. **Consistency Limits:** Determination and various indices – plasticity index, consistency index, liquidity index – uses and applications of consistency limits in soil engineering, activity ratio.	CO1
UNIT-2	**Classification:** – I.S and MIT grainsize classification, Indian standard classification for fine grained and coarse grained soils for general engineering purposes **Soil Hydraulics:** Types of soil water, Darcy's law and its limitations, determination of coefficient of permeability, laboratory methods-constant head and variable head permeameter tests, factors influencing coefficient of permeability, permeability of stratified soils, stress principle for saturated soils-total, neutral and effective stresses, no flow, downward flow and upward flow conditions, quick sand conditions, critical hydraulic gradient, piping failures in dams founded on permeable formations	CO2
UNIT-3	**Stress Distribution:** Boussinesq theory for the determination of vertical stresses due to point loads, assumptions and validity, extension to circular loaded areas, equivalent point load method, 2 : 1 approximate method, Westergaard's theory & equation, Newmark's influence chart - construction and use, contact pressure distribution beneath rigid footings	CO3
UNIT-4	**Consolidation:** Oedometer Tests, e-p and e-log p curves – compression index, coefficient of compressibility and coefficient of volume change, Terzaghi's	CO4

	assumptions for one dimensional consolidation, equation and application, coefficient of consolidation, degree of consolidation vs time, initial compression, primary compression and secondary compression, normally consolidated, over consolidated and under consolidated clayey deposits, **Compaction:** Mechanism of compaction, factors affecting compaction, effect of compaction on engineering properties of soils, field compaction equipment and quality control.	
UNIT-5	**Shear Strength of Soils:** Stress at a point, Mohr circle of stress, Mohr-coulomb's failure theory, shear tests – direct shear box, unconfined compression, tri-axial compression, and field vane shear tests, shear parameters, types of shear tests in the laboratory based on drainage conditions, shear strength of sands, critical void ratio, thixotropy and dilatancy of sands.	**CO5**

Learning Resources

Text Books	1. B.C. Punmia, Soil Mechanics and Foundations, (SI Modules), 16/e Laxmi Publications, Sixteenth edition (2017). 2. Gopala Ranjan and A.S.R, Rao, Basic and Applied Soil Mechanics, 2/e, New Age International Publishers, Third edition 2016. 3. Dr. K. R Arora, Soil Mechanics and Foundation Engineering, Standard Publisher Dist, 2009.
Reference Books	1. C. Venkataramaiah, Geotechnical Engineering, New Age International, 2006. 2. M. Braja Das, Principles of Geotechnical Engineering,Cengage Learning, 2013. 3. P. Donald, Coduto, Geotechnical Engineering, Prentice-Hall India, 2010.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105/101/105101201/ 2. http://jntuk-coeerd.in/

19CE3404 - CONSTRUCTION MATERIALS & CONCRETE TECHNOLOGY

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19BS1101 – Engineering Mathematics – I 19BS1102 -Chemistry of Materials		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the importance of stone/ brick/ wood/timber/plywood/bamboo as an effective building material in construction	K2
CO2	**Describe** the various functional components of a building.	K2
CO3	**Understand** the importance of various ingredients of concrete	K2
CO4	**Understand** the manufacturing process and properties of fresh concrete	K2
CO5	**Apply** basic requirements of the IS design specifications for designing concrete mixes based on strength and durability characteristics	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Construction Materials:** Stones and Bricks - Properties of building stones, classification of stones, stone quarrying, Manufacturing of bricks various types of bricks and blocks used for construction, tests on bricks and blocks; Wood: Classification of various types of woods used in buildings; Timber – seasoning of timber, Defects in Timber Market forms – Industrial timber– Plywood – Veneer –panels of laminates; Bamboo-suitability as a building material	CO1
UNIT-2	**Construction Practices:** Types of Structural systems -load bearing structure- framed structure- load transfer mechanism; Foundations – Deep foundation and its types, Shallow foundations and its types; Masonry -Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry; Mortar: Importance, properties and types of mortar; Finishing- Damp Proofing, water proofing materials and their uses, Plastering, Paints, Ingredients, types, white washing and distempering.	CO2
UNIT-3	**Concrete Ingredients:** Cement:Portland cement – chemical composition – Manufacturing - Hydration, Setting of cement – Structure of hydrated cement – Field and Laboratory testing – Types of cement. Aggregates:Classification of aggregate Particle size, shape & texture, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Soundness of aggregate –Sieve analysis – Fineness modulus – Grading of fine & coarse Aggregates – Alternatives to river sand	CO3
UNIT-4	**Admixtures and Fresh Concrete:**	CO4

	Admixtures: Benefits of admixtures, Classification of admixtures, Fly ash , GGBS, Silica fume, accelerators, retarders , water- reducing admixtures, super plasticizer Fresh Concrete: Properties of fresh concrete, workability, factors affecting workability, measurement of workability, Segregation and Bleeding, Process of manufacture of concrete, quality of mixing water.	
UNIT-5	**Hardened Properties and Mix Proportioning:** Strength & Durability of Concrete: Water/cement ratio, factor affecting strength of concrete, Tests on hardened concrete, Durability, Factors affecting durability; Sulfate attack, alkali aggregate reaction, Carbonation of concrete Mix proportioning: - Factors affecting the mix proportioning of Concrete, proportioning of concrete mixes by– IS 10262- 2019 and IS 456.	**CO5**

Learning Resources

Text Books	1. S.C. Rangwala, Engineering Materials, 4/e, Charotar Publishing House, 2014. 2. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications, 2005 3. M.S. Shetty, Concrete Technology, 7/e, S.Chand and Company Ltd, 2015.
Reference Books	1. P.C. Varghese, A Text Book Building Materials, 1/e, Prentice-Hall, Publication, 2005. 2. A.M. Neville and J.J. Brooks, Concrete Technology, 2/e, Prentice Hall, 2010. 3. P.K.Mehta, Concrete: Microstructure, Properties and Materials, 4/e, McGraw-Hill Education, 2014. 4. A.R.Santha Kumar, Concrete Technology, 2/e, Oxford University Press India, 2018.
e-Resources& other digital material	1. http://.nptel.ac.in/105102012/lec41.pdf 2. https://nptel.ac.in/courses/105102088/

Course Category:	Mandatory Course		Credits:	0
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Enable** the student to **understand** the importance of constitution	K2
CO2	**Understand** philosophy of fundamental rights and duties	K2
CO3	**Understand** the structure of Union government and central and state relation, with respect to financial and administrative, executive, legislature and judiciary	K2
CO4	**Understand** the structure of State and local government with respect to financial and administrative, executive, legislature and judiciary	K2
CO5	**Understand** the autonomous nature of constitutional bodies like Supreme Court and high court, comptroller and auditor general of India and election commission of India, UPSC, SPSCs and NHRC etc.,	K2

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								3						
CO2						3	2	2		1				
CO3								3						
CO4								3						
CO5						2		3						
Avg.						2	2	3		1				

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION TO INDIAN CONSTITUTION** Constitutional history, constituent assembly, salient features of the constitution, significance of preamble, amending process of the constitution.	**CO1**
UNIT-2	**RIGHTS AND DUTIES** Citizenship, fundamental rights and directive principles, fundamental duties	**CO2**
UNIT-3	**UNION GOVERNMENT** President and vice president, election, removal and powers, prime minister and council of ministers, parliament, supreme court, union, state relations, emergency provisions.	**CO3**
UNIT-4	**STATE AND LOCAL GOVERNMENTS** Governor, state legislature, assembly and council, chief minister and council of ministers, high court, rural and urban local governments with special reference to 73rd and 74th constitutional amendment acts.	**CO4**
UNIT-5	**OTHER CONSTITUTIONAL AND STATUTORY BODIES** Comptroller and auditor general, election commission, finance commission, attorney general and advocate general, union public service commission (UPSC), state public service commissions (SPSCs), tribunals, national human rights commission (NHRC).	**CO5**

Learning Resources

Text Books	1. J. C. Johari, Indian Government and Politics, Vishal Publications, Delhi,2009. 2. M. V. Pylee, Introduction to the Constitution of India, 5/e, Vikas Publishing House, Mumbai, 2007.

Reference Books	1. D.D. Basu, Introduction to the Indian Constitution, 21/e, Lexis Nexis, Gurgaon, India, 2011. 2. Subhas C. Kashyap, Our Constitution, 2/e, National Book Trust India, New Delhi,2013
e-Resources& other digital material	1. http://nptel.ac.in/courses.php 2. http://jntuk-coeerd.in/

19ES1451- AI TOOLS LAB

Course Category:	Engineering Sciences		Credits:	1
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-2
Prerequisites:	Nil		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Apply** various preprocessing techniques on different datasets.	K3
CO2	**Construct** Machine learning programs for Supervised, Unsupervised and Semi supervised learning models.	K6
CO3	**Develop** Deep learning programs for Supervised & Unsupervised learning models.	K6
CO4	**Identify** and **Apply** Artificial Intelligence concepts to solve real world problems.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	1	2					1		2	1	2
CO2	3	3	2	1	2					1		2	1	2
CO3	3	3	2	1	2					1		2	1	2
CO4	2	2	3	1	2		1			1		2	1	3
Avg.	**3**	**3**	**2**	1	**2**		**1**			**1**		2	1	**2**
1- Low					**2-Medium**					**3-High**				

Course Content

Experiment No.1	Apply Data pre-processing techniques.	CO1
Experiment No.2	Construct a Machine Learning model using supervised learning method.	CO2
Experiment No.3	Construct a Machine Learning model using Unsupervised learning method.	
Experiment No.4	Construct a Machine Learning model using Semi supervised learning method.	
Experiment No.5	Develop a Deep Learning model using supervised learning method.	CO3
Experiment No.6	Develop a Deep Learning model using Unsupervised learning method.	
Experiment No.7	Apply a Convolutional Neural Network for Image Classification.	
Experiment No.8	Build an AI application.	CO4

Learning Resources

e-Resources& other digital material	1. https://github.com/atinesh-s/Coursera-Machine-Learning-Stanford
	2. https://github.com/Kulbear/deep-learning-coursera

19CE3451- MECHANICS OF SOLIDS LAB

Course Category:	Program Core		Credits:	1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-3
Prerequisites:	19BS1101 – Engineering Mathematics – I 19BS1204 – Applied Physics		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Assess** the tensile strength of steel specimen	K3
CO2	**Determine** the shear strength of the material	K3
CO3	**Verify** the theories related to the beams	K3
CO4	**Determine** the hardness and impact properties of materials	K3
CO5	**Determine** the rigidity modulus of steel specimen	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			3					3			3	3	
CO2	3			3					3			3	3	
CO3	3			3					3			3	3	
CO4	3			3					3			3	3	
Avg.	3			3					3			3	3	

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Stress-strain characteristics of tension members using Universal Testing Machine.	CO1
Experiment No.2	Shear resistance using double shear test.	CO2
Experiment No.3	Determination of Young's modulus by conducting load deflection test on simply supported beam	CO3
Experiment No.4	Determination of Young's modulus by conducting load deflection test on cantilever beam	
Experiment No.5	Determination of Young's modulus by conducting load deflection test on continuous beam	
Experiment No.6	Verification of Maxwell's reciprocal theorem on simply supported beam	
Experiment No.7	Verification of Maxwell's reciprocal theorem on cantilever beam	
Experiment No.8	Determination of hardness of metals using Rockwell's hardness test.	CO4
Experiment No.9	Impact test by using Izod's method	
Experiment No.10	Impact test by using Charpy's method	
Experiment No.11	Modulus of rigidity by conducting torsion test on rods.	CO5
Experiment No.12	Modulus of rigidity by conducting compression test on springs.	

Learning Resources

Text Books & Reference Manuals	3. Mechanics of Soids Lab Manual by Dept. of CE, PVPSIT 4. IS 1608 (2005): Mechanical testing of metals - Tensile Testing [MTD 3: Mechanical Testing of Metals] 5. IS 1500 (2005): Method for Brinell Hardness Test for Metallic Materials [MTD 3: Mechanical Testing of Metals] 6. IS 1501: Method For Vickers Hardness Test for Metallic Materials

	7. BIS IS 1598 : 1977(R2015): method for izod impact test of metals
	8. BIS IS 1757 : 1988(R2009): Method for Charpy impact test (v-notch) for metallic material
	9. IS 1717: Metallic Materials - Wire - Simple Torsion Test
	10. S. Timoshenko, Strength Of Materials: Elementary Theory and Problems-Vol.I, 2004.
Reference Books	1. R. Subrahmanian, Strength of Materials, 3/e, Oxford University Press,2016.
e-Resources& other digital material	1. sm-nitk.vlabs.ac.in 2. http://jntuk-coeerd.in/

19CE3452- ENVIRONMENTAL ENGINEERING LAB

Course Category:	Program Core		Credits:	1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-3
Prerequisites:	19CE3402- Environmental Engineering 19BS1102- Chemistry of Materials		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Conduct** the experimental testing of pH, turbidity, conductivity and alkalinity or acidity tests and understand their significance and application	K3
CO2	**Conduct** the experimental testing of chlorides, total organic, inorganic solids and iron tests in water and understand their significance and application	K3
CO3	**Conduct** the experimental testing of dissolved oxygen, nitrogen and phosphorous tests in water and understand their significance and application	K3
CO4	**Conduct** various waste water quality parameters-BOD & COD and understand their significance and application.	K3
CO5	**Conduct** Presumptive coli form test.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				3	3				2				2	2
CO2				3	3				2				2	2
CO3				3	3				2				2	2
CO4				3	3				2				2	2
Avg.				3	3				2				2	2

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Determination of pH and Turbidity.	CO1
Experiment No.2	Determination of Conductivity and Total dissolved solids	
Experiment No.3	Determination of Alkalinity/Acidity	
Experiment No.4	Determination of Chlorides	CO2
Experiment No.5	Determination and Estimation of total solids, organic solids and inorganic solids	
Experiment No.6	Determination of iron.	
Experiment No.7	Determination of Dissolved Oxygen.	CO3
Experiment No.8	Determination of Nitrogen	
Experiment No.9	Determination of total Phosphorous	
Experiment No.10	Determination of B.O. D	CO4
Experiment No.11	Determination of C.O. D	
Experiment No.12	Determination of Optimum coagulant dose	
Experiment No.13	Determination of Chlorine demand	
Experiment No.14	Presumptive coli form test	CO5

Learning Resources

Text Books & Reference Manuals	1. Chemistry for Environmental Engineering by (4th edition) by Sawyer and Mc. Carty, McGraw - Hill International Book Company, 1994. 2. IS codes (testing) & (standard values) for water 3. Standard Methods for Analysis of water and Waste Water – APHA
e-Resources& other digital material	1. NME-ICT, MHRD, NITTTR Chennai

19CE3453- GEOTECHNICAL ENGINEERING LAB

Course Category:	Program Core		Credits:	1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:	0-0-3
Prerequisites:	19CE3402- Environmental Engineering 19BS1102- Chemistry of Materials		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Determine** index soil properties and understand their significance and application	K3
CO2	**Determine** basic soil properties and understand their significance and application	K3
CO3	**Determine** engineering soil properties and understand their significance and application	K3
CO4	**Determine** compaction & consolidation characteristics and understand their significance and application	K3
CO5	**Determine** strength characteristics and understand their significance and application	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3	3									3	3
CO2			3	3									3	3
CO3			3	3									3	3
CO4			3	3									3	3
Avg.			3	3									3	3

1- Low	2-Medium	3-High

Course Content

Experiment No.1	**Determine Atterberg's limits** Liquid Limit Test Plastic Limit Test Shrinkage Limit Test	CO1
Experiment No.2	**Investigate dry density of soil** Core cutter method Sand Replacement method	CO1
Experiment No.3	**Conduct grain size analysis of coarse grade and fine grade soils** Dry Sieve Analysis Wet Sieve Analysis Hydrometer Analysis	CO2
Experiment No.4	**Determine coefficient of permeability** Constant Head Test Falling Head Test	CO2
Experiment No.5	**Measure compaction characteristics of soil** Standard Proctor Test Modified Proctor Test	CO3
Experiment No.6	**Determine engineering properties of consolidation** Consolidation Test	CO3
Experiment No.7	**Measure unconfined compression strength of soil** Unconfined compression test	CO4
Experiment No.8	**Determine shear strength of soil** Direct shear test Vane shear test CBR Test	CO5

Learning Resources

Text Books	1. Basic and Applied Soil Mechanics – Gopal Ranjan and A.S.R.Rao, New Age International Publishers 2. Soil Mechanics and Foundation Engg (7th edition) by Dr. Arora, K.R., Standard Publisher and Distributors, Delhi, 2010. 3. A Text book of Soil Mechanics and Foundation Engineering – B.C.PunmiaLaxmi Publications
Reference Books	1. Foundation Analysis & Design by Bowles, J.E., McGraw- Hill Book Co. 2. A Text book of Soil Mechanics and Foundation Engineering – P.Purushotthama Raj, Pearson Education 3. Introduction to Soil Mechanics- Braja M Das
e-Resources& other digital material	1. https://nptel.ac.in/courses/105/101/105101201/ 2. http://jntuk-coeerd.in/

19CE3454- CONSTRUCTION MATERIALS & CONCRETE TECHNOLOGY LAB

Course Category:	Program Core		Credits:		1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:		0-0-3
Prerequisites:	19BS1101 – Engineering Mathematics – I 19BS1102 -Chemistry of Materials		Continuous Evaluation:		25
			Semester End Evaluation:		50
			Total Marks:		75

Course Outcomes

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

CO1	**Assess** the different properties of Cement	K3
CO2	**Determine** the different properties of aggregates	K3
CO3	**Describe** the preparation of green concrete	K2
CO4	**Summarizes** the concept of workability and testing of concrete	K4
CO5	**Demonstrate** the properties of hardened concrete	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				3					3			3	3	
CO2				3					3			3	3	
CO3				3					3			3	3	
CO4				3					3			3	3	
Avg.				3					3			3	3	

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Tests on Cement - Determination of fineness and consistency of cement.	CO1
Experiment No.2	Tests on Cement - Determination of setting time of cement	
Experiment No.3	Tests on Cement - Determination of specific gravity of cement	
Experiment No.4	Tests on Cement - Determination of compressive strength of cement	
Experiment No.5	Tests on Aggregates-Determination of fineness modulus of fine aggregate and coarse aggregate	CO2
Experiment No.6	Tests on Aggregates-Determination of specific gravity of fine aggregate and coarse aggregate.	
Experiment No.7	**Mix proportioning and conducting trial mixes** 1. Determine the mix proportions of materials for a particular grade of concrete as per IS10262. 2. Conducting trials for M20, M30 and M40 grades of Concrete	CO3
Experiment No.8	**Tests on Fresh Concrete -** Determination of workability of concrete by slump cone test.	CO4
Experiment No.9	**Tests on Fresh Concrete -** Determination of workability of concrete by compaction factor apparatus.	
Experiment No.10	**Tests on Hardened Concrete -** Determination of compressive strength of concrete.	CO5
Experiment No.11	**Tests on Hardened Concrete -** Determination of split tensile strength of concrete	
Experiment No.12	**Tests on Hardened Concrete -** Determination of modulus of rupture of plain concrete beam.	
Experiment No.13	Demonstration of Rebound Hammer test and Ultrasonic Pulse Velocity Test	

Learning Resources

Text Books & Reference Manuals	1. Concrete Technology Lab Manual by Dept. of CE, PVPSIT 2. Determination of fineness and consistency of cement. IS 4031(Part 4) & IS 4031(Part 1) 3. Determination of setting time of cement. IS 4031(Part 5) 4. Determination of specific gravity of cement (IS:4031-PART 11) 5. Determination of compressive strength of cement. IS 4031(Part 6) & IS 4031(Part 7) 6. Determination of fineness modulus of fine aggregate and coarse aggregate IS:383 7. Determination of specific gravity of fine aggregate and coarse aggregate. IS:2386 (Part 3) 8. Determine the mix proportions of materials for a particular grade of concrete as per IS 10262. 9. Determination of workability of concrete by slump cone test. **IS: 1199** 10. Determination of workability of concrete by compaction factor apparatus. **IS: 1199** 11. Determination of compressive strength of concrete. IS 516. 12. Determination of split tensile strength of concrete. IS 5816. 13. Determination of modulus of rupture of plain concrete beam. IS 516. 14. M. S. Shetty, Concrete Technology, S Chand Publications.
Reference Books	1. M. L. Gambhir, Concrete Technology, Mcgraw Hill Education.
e-Resources& other digital material	1. http://jntuk-coeerd.in/

V - SEMESTER SYLLABUS

Course Category:	Engineering Sciences		Credits:	2
Course Type:	Theory		Lecture-Tutorial-Practical:	2-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Summarize** the genesis and impact of IoT applications, architectures in real world.	K2
CO2	**Illustrate** diverse methods of deploying smart objects and connect them to network.	K3
CO3	**Construct** simple applications using Arduino.	K3
CO4	**Interpret** different protocols and select which protocol can be used for a specific application.	K2
CO5	**Identify** and develop a solution for a given application using APIs.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**GENESIS OF IOT** IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	CO1
UNIT-2	**SMART OBJECTS** The Things in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	CO2
UNIT-3	**EMBEDDED COMPUTING BASICS** Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness.	CO3
UNIT-4	**Communication in the IoT** Internet Principles, Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.	CO4
UNIT-5	**Prototyping Online Components** Getting Started with an API, Mashing Up APIs, Scraping, Legalities, Writing a New API, Clockodillo, Security, Implementing the API, Using Curl to Test, Going Further, Real-Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport, Extensible Messaging and Presence Protocol, Constrained Application Protocol.	CO5

Learning Resources

Text Books	1.Adrian McEwen, Hakim Cassimally - Designing the Internet of Thing Wiley Publications, 2012.

	2.David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
Reference Books	1.ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014
	2.Srinivasa K G, Internet of Things,CENGAGE Leaning India, 2017
e-Resources& other digital material	1. http://nptel.ac.in/courses.php 2. http://jntuk-coeerd.in/

19CE3501 - STRUCTURAL ANALYSIS

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3301- Engineering Mechanics 19CE3401- Mechanics of Solids		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Evaluate** the slopes and deflection in beams and pin jointed frames.	K5
CO2	**Evaluate** the fixed end moments in fixed beams and can analyse two span continuous beams by slope deflection method	K5
CO3	**Analyse** the two span continuous beams by Moment distribution Method and Kani's method	K4
CO4	**Evaluate** the stresses for both concentrically loaded and eccentrically loaded Columns.	K5
CO5	**Evaluate** the stress strain behaviour of both the thin and thick cylinders.	K5

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Deflection of Statically Determinate Structures:** Introduction, Pure bending, Relation between curvature, slope and deflection, Deflection curves, Maculay's Method, Moment area method, Slopes and deflection for cantilevers and simply supported beams Deflection Of pin jointed frames: Deflection of trusses by Unit load method (having 9 members or less)	CO1
UNIT-2	**Analysis of Indeterminate Beams** Fixed beams: Shear force and bending moment diagrams for Fixed beams subjected to U.D.load, central point load, eccentric point load. Number of point loads, uniformly varying load, couple and combination of loads, effect of sinking of support, effect of rotation of a support. Two span continuous beams: Shear force and bending moment diagrams for two span continuous beams with and without sinking of supports using Slope deflection method.	CO2
UNIT-3	**Analysis of two span continuous beams** Moment distribution method: Shear force and bending moment diagrams for two span continuous beams with and without sinking of supports using Moment Distribution Method. Kani's method: Shear force and bending moment diagrams for two span continuous beams with and without sinking of supports using Kani's Method	CO3
UNIT-4	**Columns and Struts** Introduction, Column with one end free and other fixed, Column with both ends hinged, column with both ends fixed, column with one end fixed and the other hinged, Limitation of Euler's formula, column carrying eccentric load, Rankine-Gordon formula, Perry's formula	CO4

UNIT-5	Combined bending and direct stresses–Introduction, Limit of eccentricity for no tension in the section, kernel of a section for rectangular, circular sections.	
	Thin Cylinders - Introduction, Stresses and strains in thin cylinders, volumetric change in cylinder. **Thick cylinders:**thick cylinders subjected to internal pressure and external pressure, compound cylinders.	**CO5**

Learning Resources

Text Books	1. S.S.Bhavikatti, Structural Analysis Vol.I& II, Vikas Publishing House Pvt.Ltd, 2011. 2. V.N Vazirani and M.M Ratwani, Analysis of Structures Vol-II, Khanna Publishers, 2012
Reference Books	. C.K.Wang, Statically Indeterminate Structures, TataMcGrawHill, 2010. 2. R.C. Hibbeler, Structural Analysis, 6/e, Pearson, 2011.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105101085/25-31 2. https://onlinecourses.nptel.ac.in/noc17_ce25/preview 3. https://www.edx.org/learn/structural-engineering

19CE4501A – REPAIR AND REHABILITATION OFSTRUCTURES

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3404 - Construction Materials and Concrete Technology		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Identify** the physical causes for deterioration of concrete	K1
CO2	**Assess** the damage through semi destructive and Non-destructive testing methods	K2
CO3	**Categorize** the suitable repair materials.	K6
CO4	**Identify** and analyse various cracks and its repair methods.	K1
CO5	**Demonstrate** the various rehabilitation and strengthening techniques	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Durability and Deterioration of Concrete** **Physical causes:** Durability of concrete, causes of distress in concrete structures, Shrinkage in concrete, honeycombing in concrete, creep of concrete, Temperature changes – Internally generated temperature differences, externally generated temperature differences, Fire on concrete, Thermal movement in concrete, **Corrosion:** Corrosion process, Damages due to corrosion	CO1
UNIT-2	**Damage Assessment** Investigation of Damage- Observation, Assessment Procedure Non-Destructive Testing Methods: Introduction, Non-Destructive Testing Methods, Surface Hardness Test, Ultrasonic Pulse velocity test, Semi-Destructive Testing Systems: Core Sampling and Testing, Half -Cell potential survey	CO2
UNIT-3	**Repair Materials** Polymeric repair materials, Polymeric coatings, Polymer concrete/mortar composites, Fibre reinforced concrete, Glass fibre reinforced concrete, Polypropene fibre, Carbon fibres, fibre reinforced polymer composites, Concrete made with industrial wastes, Bacterial concrete.	CO3
UNIT-4	**Evaluation and Repair of Cracks:** Symptoms and Diagnosis of Distress, Evaluation of cracks, Selection of Repair Procedure, Repair of cracks-Preparation of Surface, Repair Techniques, Common types of repairs: Sealing of cracks, Flexible sealing, providing additional steel, Stitching of cracks, Repair by jacketing, Autogenous Healing.	CO4
UNIT-5	**Rehabilitation and Strengthening Techniques** **Rehabilitation Techniques:** **Replacement Mortar- Epoxy bonded epoxy mortar,**	CO5

| | Replacement Concrete- Epoxy-bonded Replacement concrete, Application, Shotcrete or Gunite, Grouting- Portland Cement Grouts, Polymer Grouts, Epoxy Grouting, Resin injection, Sprayed concrete, Slab jacking technique, Cathodic Protection **Strengthening methods:** Introduction-Need for strengthening, Structural Concrete Strengthening, Column Strengthening, Strengthening with external reinforcement, External Post-tensioning, Section Enlargement, Guidelines for Seismic rehabilitation of existing buildings. | |

Learning Resources

Text Books	1. B.Vidivelli, Rehabilitation of Concrete Structures, 1/e, Standard Publishers Distributors, 2018. 2. M.L.Gambhir, Concrete Technology: Theory and Practice, 4/e, Tata McGraw Hill Education Private Limited, 2013. .
Reference Books	1. Peter.H.Emmons and Gajanan.M.Sabnis, Concrete Repair and Maintainence, 2/e, Galgotia Publications Pvt Ltd, 1992. 2. S.Mahaboob Basha, A textbook of Concrete Technology, 1/e, Anuradha Publications, 2011. 3. J.Bhattacharjee, Concrete Structures Repair Rehabilitation and Retrofitting, 1/e, CBS, 2017. P.C.Varghese, Maintenance Repair and Rehabilitation and Minor works of Buildings, 1/e, Prentice Hall India Learning Private Limited, 2014.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105/106/105106202/ - 2. https://freevideolectures.com/course/3489/ocean-structures-and-materials/16 3. https://www.rilem.net/agenda/repair-and-rehabilitation-of-concrete-structures-1242

19CE4501B - FOUNDATION ENGINEERING

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3405 - Geotechnical Engineering		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the sampling methods used in-site.	K2
CO2	**Understand** the various types of shallow foundations and decide on their location based on soil characteristics.	K2
CO3	**Design** Piles based on the principles of bearing capacity.	K3
CO4	**Estimate** the earth pressures.	K5
CO5	**Analyse** the stability of slopes	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2								3	2
CO2	3	2	2										3	2
CO3	3	2			2								3	2
CO4	3	2											3	2
CO5	3	2	2										3	2
Avg.	3	2	**2**										3	2

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Subsoil Exploration** Methods of subsoil exploration, direct, indirect methods, soundings by standard, dynamic cone and static cone penetration tests. Boring & Sampling: Types of boring, types of samples, criteria for undisturbed samples, transport and preservation of samples, bore-logs, planning of exploration programs, report writing.	CO1
UNIT-2	**Shallow Foundations**, **Bearing Capacity Criteria** Types of foundations and factors to be considered in their location, bearing capacity, criteria for determination of bearing capacity, factors influencing bearing capacity, analytical methods to determine bearing capacity, Terzaghi's theory, IS Methods. **Settlement Criteria:** Safe bearing pressure based on N- value, allowable bearing pressure; safe bearing capacity and settlement from plate load test, Types of foundation settlements and their determination, allowable settlements of structures.	CO2
UNIT-3	**Pile Foundations** Classification, load carrying capacity of single pile, dynamic formula, static formula, pile load, cyclic pile load tests, load capacity of pile groups, Feld's rule, average efficiency of pile groups, settlement of pile groups, negative skin friction on plies, under reamed pile foundations in expansive sub-soils. **Caissons:** Introduction, various forces acting and types of caissons: box, open (well), pneumatic, different shapes and cross sections of well foundations, different components of well, grip length, problems in well sinking and remedial measures.	CO3
UNIT-4	**Earth Pressure** Types of earth pressures, Rankine's active and passive earth pressures, smooth	CO4

	vertical wall with horizontal backfill, extension to Coulomb's wedge theory, Rebhann's graphical method for active earth pressure. **Bulkheads:** Classification, introduction to ground improvement techniques.	
UNIT-5	**Stability of Slopes** Infinite and finite earth slopes in sand and clay, types of failures, factors influencing slope stability. Stability Analysis: Swedish slip circle – ∅ = 0 analysis, c-∅ analysis, Fellinius method of locating critical slip centre, friction circle methods, Taylor's stability number, Bishop's method of stability analysis.	**CO5**
<center>**Learning Resources**</center>

Text Books	1. Gopala Ranjan and A.S.R. Rao, Basic and Applied Soil Mechanics, New age Publishers, 2000. 2. C. Venkataramaiah, Geotechnical Engineering, New Age Publishers, 2006...
Reference Books	4. V.N.S. Murthy, Soil Mechanics, Foundation Engineering, UBS Publishers, 2011. 5. J.E. Bowles, Foundation Analysis and Design, McGraw Hill, Publishers, 2001. 6. M.D. Braja, Principles of Geotechnical Engineering, 7/e, Cengage Learning: 2013. 7. P.C. Donald, Geotechnical Engineering, Prentice-Hall India, 2010. 8. Rodrigo Salgado, The Engineering of Foundations, Mcgraw Hill, 2006. Iqbal H, Khan, Textbook of Geotechnical Engineering, Prentice Hall of India,2005.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105105176/ http://jntuk-coeerd.in/

19CE4501C – PAVEMENT ANALYSIS AND DESIGN

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19BS1101- Engineering Mathematics I 19CE3502 - Highway Engineering		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Comprehend** the material specifications and design factors of pavements	K1
CO2	**Analyse** stresses in flexible and rigid pavements	K4
CO3	**Design** of flexible and rigid pavements	K5
CO4	**Study** the constructional operations and equipment	K1
CO5	**Comprehend** the concept of strengthening of existing pavements and pavement management system	K1

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					2							3	2
CO2	3	3			2	2							3	2
CO3	3	3			2	2							3	2
CO4	3												3	2
CO5	3												3	2
Avg.	3												3	2

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**DESIGN FACTORS** Types of pavements – Factors affecting design of pavements – wheel loads – ESWL Concept- tyre pressure – contact pressure, Material characteristics – Environmental and other factors. **MATERIAL CHARACTERISTICS** Highway Materials – Soil, Aggregate, Bitumen and Tar- Tests on aggregates - Tests on Bitumen -Marshall's Method of Bituminous Mix design.	**CO1**
UNIT-2	**STRESSES IN FLEXIBLE PAVEMENT** Stresses in flexible pavement – layered systems concept – one layer system – Boussinesq Two-layer system – Burmaster Theory for Pavement Design **STRESSES IN RIGID PAVEMENT** Stresses in rigid pavements – stresses due to warping, stresses due to loads, stresses due to friction.	**CO2**
UNIT-3	**FLEXIBLE PAVEMENT DESIGN** CBR Method of Flexible Pavement Design- IRC method of flexible pavement design. -AASTHO Method of Flexible Pavement design **RIGID PAVEMENT DESIGN** IRC method of Rigid pavement design - Types of Joints – Use of Tie Bars and Dowell Bars. Design of RCC pavements	**CO3**
UNIT-4	**HIGHWAY CONSTRUCTION** Introduction – Construction of Earth Roads- Gravel Roads – WBM Roads- Bituminous Pavements- Cement Concrete Roads **ADVANCES IN HIGHWAY CONSTRUCTION AND CONSTRUCTION EQUIPMENTS** Steps in Construction- Reinforced Concrete Pavements – Soil Stabilization – Methods and Objectives- Soil-cement Stabilization and Soil-lime Stabilization,	**CO4**

	Specific equipment for bituminous roads and for concrete roads construction	
UNIT-5	**PAVEMENT MANAGEMENT SYSTEM** Need for Highway Maintenance- Failures in Flexible Pavements-Rigid Pavement Failures- Pavement Evaluation-Benkelman Beam method- Overlays Design **STRENGTHING OF EXISTING PAVEMENT** Over lay design – Types of Overlays - Methods of Overlay – Importance of Highway Drainage – Design of Surface Drainage - Design of Sub Surface Drainage.	CO5

Learning Resources

Text Books	1. Highway Engineering, (7th Edition) by Khanna S., Kand Justo C.J., Nemchand& Bros, NewDelhi, 2000. 2. Principles and Practices of Highway Engineering by KadiyaliL.R and Dr.Lal N.B., Khanna Publishers, New Delhi, 2003. 3. 3. Principles of pavement design Yoder, Jhon Willey & Sons, New Delhi, 2012.
Reference Books	1. IRC Code for flexible pavement – IRC – 37 -2001. 2. IRC Code for Rigid pavement – IRC – 58 – 2002. 3. Pavement Analysis and Design, (2nd edition) by Yang H. Huang, Pearson Education, Delhi, 2008. 4. Principles of Highway Engineering And Traffic Analysis, (4th edition) by Fred L. Mannering, Wiley student publication, India, New Delhi, 1990. 5. Construction planning, equipment and measures by Peurifoy R.L., Tata McGraw-Hill Publications, New Delhi, 2006.
e-Resources& other digital material	http://nptel.ac.in/courses.php http://jntuk-coeerd.in/

19CE4501D - HYDRAULIC MACHINES

Course Category:		Program Elective		Credits:		3
Course Type:		Theory		Lecture-Tutorial-Practical:		2-1-0
Prerequisites:		19CE3302 - Fluid Mechanics 19CE3301- Engineering Mechanics 19BS1101 - Engineering mathematics– I 19BS1201 - Engineering mathematics – II		Continuous Evaluation:		30
				Semester End Evaluation:		70
				Total Marks:		100

Course Outcomes

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

CO1	**Understand** the basic concepts of turbo machinery	K2
CO2	**Apply** basics of hydro machinery and water power engineering concepts	K3
CO3	**Analyze** and select suitable type of turbine	K4
CO4	**Analyze** performance of the centrifugal pumps	K4
CO5	**Understand** efficiency of various pumps	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**IMPACT OF FREE JETS ON VANES** Impulse Momentum Equation – Force exerted by fluid jet on stationary and moving vanes, torque exerted on a wheel with radial curved vanes, velocity triangles.	**CO1**
UNIT-2	**HYDRAULIC TURBINES:** Elements of hydropower plants, classification of turbines – Impulse Turbines (Pelton wheel), Reaction Turbines (Francis, Kaplan) –components, functioning, work done and efficiencies (theory only); applications of draft tube, surge tank.	**CO2**
UNIT-3	**PERFORMANCE OF TURBINES:** Performance under unit head and specific conditions (unit quantities), expressions for specific speeds, performance characteristic curves, cavitation in turbines, selection of turbines.	**CO3**
UNIT-4	**PUMPS:** Rotodynamic Pumps (Centrifugal Pumps) – components, working, types, work done, efficiencies, specific speed (theory only), advantages of centrifugal pumps, pumps in series and parallel.	**CO4**
UNIT-5	Functionality and working principles of Monoblock pump, submersible pump, jet pump, Tubular turbine, bulb turbine.	**CO5**

Learning Resources

Text Books	1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines,20/e, Standard Book House,2015. 2. A.K. Jain, Fluid Mechanics, 12/e, Khanna publishers,2014.
Reference Books	1. K. Subramanya, Hydraulic Machines, Tata McGraw Hill,2017. 2. L. Victor, Streeter and E. Benjamin Wylie, Fluid Mechanics, 9/e, Tata

	McGrawHill,2013.
	M. Franck White, Fluid Mechanics, Tata McGraw Hill,2014.
e-Resources& other digital material	1. https://nptel.ac.in/courses/112/104/112104117/ 2. https://nptel.ac.in/courses/112/103/112103249/

19CE4501E – POLLUTION PREVENTION & MANAGEMENT

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3404- Environmental Engineering 19BS1103- Chemistry of Materials		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the treatment and disposal methods of rural sanitation	K2
CO2	**Outline** the handling of biomedical waste and its disposal	K4
CO3	**Assess** the different characteristics of industrial wastes and their disposal methods	K2
CO4	**Identify** the sources of noise pollution and suggest methods for mitigating the problem.	K1
CO5	**Understand** the e waste generated and control measures.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Rural Sanitation**- Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system in rural areas- Treatment and Disposal of wastewater - Compact and simple wastewater treatment units and systems in rural areas- stabilization ponds - septic tanks - soak pits- low-cost excreta disposal systems- Effluent disposal.	CO1
UNIT-2	**Biomedical Waste Management**- Definition-Sources-Classification of biomedical waste – Objectives of Biomedical waste management-segregation-containers for biomedical waste-Labelling Collection- Transport-Disposal methods.	CO2
UNIT-3	**Industrial And Hazardous Waste Management** Industrial waste types, characteristics of industrial wastes, pollution from major industries, effects of industrial effluents, treatment technologies; Hazardous wastes definition, sources of hazardous waste, transportation, treatment and disposal methods and processes	CO3
UNIT-4	**Noise Pollution** Sources of noise pollution, impacts of noise, measurement of noise and permissible limits of noise. Control methods of noise pollution, The Noise Pollution (Regulation and Control) Rules, 2000 as per CPCB.	CO4
UNIT-5	**E-Waste management** Sources- Types- components; Collection process- Segregation-Disposal methods; Effect on air, water and soil; Health hazards; Role of individual for E-waste management. Current E-waste Management Rules	CO5

Learning Resources

Text Books	1. Juuti, P., Tapio S. K., and Wuorinen H., Environmental History of Water: Global Views on Community Water Supply and Sanitation, IWA Publishing (Intl Water Assoc), 2007 2. Rittmann, B.E., and McCarty, P.L., Environmental Biotechnology: Principles

	and Applications, McGraw Hill, 2001. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing.
Reference Books	1. Reddy, L.N. and Inyang. H. I., Geoenvironmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000 Industrial Wastewater Management, Treatment and Disposal, WEF Manual of practice No. FD-3, 3rd Ed., WEF Press and McGrawHill, 2008
e-Resources& other digital material	http://www.nptelvideos.in/2012/12/fundamentals-of-environmental-pollution.html

19CE3502 – HIGHWAY ENGINEERING

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19BS1101 – Engineering Mathematics – I 19CE3306 – Surveying		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Comprehend** the highway development and planning in India	K1
CO2	**Perform** geometric design of highway alignment and management of traffic	K3
CO3	**Design** traffic intersection and choose material for highway	K3
CO4	**Deal** with the design procedures of flexible and rigid pavements	K4
CO5	**Understand** the constructional and maintenance issues related to highways	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**HIGHWAYDEVELOPMENT** Highway development in India–Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports. **HIGHWAY PLANNING** Necessity for Highway Planning- Different Road Development Plans- Classification of Roads- Road Network Patterns – Planning Surveys.	CO1
UNIT-2	**HIGHWAYGEOMETRICDESIGN** Importance of Geometric Design- Highway Cross Section Elements- Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Super elevation and Extra widening- Design of Vertical Alignment- Gradients- Vertical curves. **TRAFFICENGINEERINGANDMANAGEMENT** Traffic Volume Studies- Speed studies- Parking Studies - Road Accidents-Causes and Preventive measures - Road Traffic Signs – Types – Road Markings-Types of Road Markings.	CO2
UNIT-3	**INTERSECTION DESIGN** Types of Intersections –Traffic Islands - Design of Traffic Signals –Webster Method –IRC Method. Types of Grades Separated Intersections- Rotary Intersection –Advantages and Disadvantages of Rotary Intersection. **HIGHWAYMATERIALS** Subgrade soil: California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Tests for Road Aggregates – Bituminous Materials: Tests on Bitumen – Marshall Method of Mix Design.	CO3
UNIT-4	**DESIGNOFFLEXIBLEPAVEMENTS** Objects & Requirements of pavements – Types – Functions of pavement components – Designfactors – Flexible Pavement Design Methods – CBR method – IRC method **DESIGNOFRIGIDPAVEMENTS** Design Considerations – wheel load stresses – Temperature stresses – Frictional	CO4

	stresses – Combination of stresses – Design of Joints – IRC method	
UNIT-5	**HIGHWAYCONSTRUCTION** Types of Highway Construction – Construction of Gravel Roads – Construction of Water Bound Macadam Roads – Construction of Bituminous Pavements – Construction of Cement Concrete Pavements. **ADVANCES IN HIGHWAY CONSTRUCTION** Soil stabilisation, Soil-Cement Stabilisation, Soil-Lime Stabilisation	**CO5**

Learning Resources

Text Books	1. Highway Engineering, (9th edition) by Khanna, S.K. and Justo, C.E.G., Nem Chand Bros, Roorkee, 2010. 2. Traffic Engineering and Transportation Planning, (7th edition) by Kadiyali, L.R., Khanna Publishers, New Delhi, 2010. 3. Specifications for Roads and Bridges - Manual for Maintenance of roads, Most publications, 1976.
Reference Books	1. Fundamentals of Transportation Engineering, (3rd edition) by Papacostas, C.S., Prentice Hall of India Pvt.Ltd, New Delhi, 2009. 2. Principles of Highway Engineering by Kadiyali, L.R., Khanna Publishers, New Delhi, 2012. 3. Traffic Planning and Design by Saxena, Dhanpat Rai Publishers, New Delhi, 2010. 4. Transportation Engineering - An Introduction, (3rd edition) by JotinKhisty. C, Prentice Hall, Englewood Cliffs, New Jersey, 2012.
e-Resources& other digital material	http://nptel.ac.in/courses.php http://jntuk-coeerd.in/

19CE3503 – DESIGN OF REINFORCED CONCRETE STRUCTURES

Course Category:	Program Core		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19CE3401- Mechanics of Solids		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Demonstrate** the knowledge of concrete design philosophies, by working and limit state methodology	K2
CO2	**Apply** the principles, procedures and current code requirements to the analysis and design of reinforced concrete beams under flexure by limit state method.	K3
CO3	**Identify** the behaviour of reinforced concrete members in bond, anchorage, shear and torsion	K1
CO4	**Analyze** and design reinforced concrete One way and Two-way slabs.	K4
CO5	**Analyze** and design reinforced concrete compression members.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	Loading standards as per IS 875, grades of steel and concrete, introduction to working stress, ultimate load and limit state methods. Working stress method: Assumptions, flexure of RCC beams of rectangular section, under reinforced, balanced and over-reinforced sections, analysis and design of singly reinforced beams of rectangular sections using working stress method.	CO1
UNIT-2	**LIMIT STATE METHOD** RCC beams of rectangular sections under flexure, under reinforced, balanced and over-reinforced sections, analysis and design of singly and doubly reinforced beams of rectangular sections; Design of T beams: effective flange width, analysis and design of T-beams	CO2
UNIT-3	**SHEAR AND TORSION**: Limit state of collapse in shear, types of shear failures, truss analogy, shear, span/depth ratio, calculation of shear stress, types of shear reinforcement, design for shear in beams, analysis for torsional moment in a member, torsion shear stress in rectangular sections, reinforcement for torsion in RCC beams.	CO3
UNIT-4	**DESIGN OF ONE-WAY AND TWO-WAY SLABS** (using IS 456), method of analysis, classification of slabs, design of one way simply supported slab, behavior of two-way slab, types of two-way slabs, analysis of two-way slabs, design of two-way slabs with different edge conditions.	CO4
UNIT-5	**COLUMNS:** Short columns, minimum eccentricity, column under axial compression, analysis and design of short columns subjected to uniaxial moment, analysis and design of short columns subjected to bi- axial moments. Footings: Design of isolated footings for a column subjected to axial loading.	CO5

Learning Resources

Text Books	1. Pillai and Menon, Reinforced Concrete Design, 3/e, Tata McGraw Hill, 2017.

	2. A.K. Jain, Reinforced Concrete – Limit State Design, 7/e, Standard book house, 2012.
Reference Books	1. P.C. Varghese, Limit State Design of Reinforced Concrete, 2/e, Prentice Hall of India, 2013. 2. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University, 2014.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105105105/1 2. https://nptel.ac.in/downloads/105105104/

Course Category:	Engineering Sciences		Credits:	1
Course Type:	Practical		Lecture-Tutorial-Practical:	0-0-2
Prerequisites:	Nil		Continuous Evaluation:	25
			Semester End Evaluation:	50
			Total Marks:	75

Course Outcomes

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

CO1	**Develop** various sensor interfacing using Visual Programming Language	K6
CO2	**Analyze** various Physical Computing Techniques	K4
CO3	**Evaluate** Wireless Control of Remote Devices	K5
CO4	**Design and develop** Mobile Application which can interact with Sensors and Actuators	K6
CO5	**Develop** various sensor interfacing using Visual Programming Language	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	3	PO5	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	2	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	2	3	3	2	3	3	3	3	3	3
Avg.	3	3	3	3	2	3	3	2	3	3	3	3	3	3

1- Low		**2-Medium**		**3-High**	

Course Content

Experiment No.1	Digital I/O Interface - Multicolour Led, IR Sensor, PIR, Slot Sensor.	CO1
Experiment No.2	Analog Read and Write - Potentiometer, Temperature Sensor, Led Brightness Control.	CO1
Experiment No.3	Dc Motor Control - Dc Motor Speed and Direction Control.	CO2
Experiment No.4	Read data from sensor and send it to a requesting client. (Using socket communication) Note: The client and server should be connected to same local area network.	CO2
Experiment No.5	Fabrication and direction control of wheeled robot using Arduino.	
Experiment No.6	Serial Communication - Device Control.	CO2
Experiment No.7	Wireless Module Interface - Bluetooth and Wifi.	CO3
Experiment No.8	Wireless Control of wheeled Robot using Bluetooth/Wifi.	CO3
Experiment No.9	Basic Android App Development using MIT App Inventor.	
Experiment No.10	Smart Home Android App Development using App Inventor and Arduino.	CO4

Learning Resources

Text Books & Reference Manuals	1. Sylvia Libow Martinez, Gary S Stager, "Invent To Learn: Making, Tinkering, and Engineering in the Classroom", Constructing Modern Knowledge Press, 2016.
Reference Books	2. Michael Margolis, "Arduino Cookbook", Oreilly, 2011

19CE3551 – HIGHWAY ENGINEERING LAB

Course Category:	Program Core		Credits:		1.5
Course Type:	Practical		Lecture-Tutorial-Practical:		0-0-3
Prerequisites:	19BS1101 – Engineering Mathematics – I 19CE3306 – Surveying		Continuous Evaluation:		25
			Semester End Evaluation:		50
			Total Marks:		75

Course Outcomes

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

CO1	Understand road aggregate suitability in pavement construction.	K2
CO2	Understand bituminous material suitability in pavement construction.	K2
CO3	Determine the mix proportions of the Bituminous mixes and subgrade properties.	K1
CO4	Study the volume, speed studies, traffic surveys at mid-block, intersection and parking study.	K1
CO5	Study the air pollution and noise pollution.	K1

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3	3									3	3
CO2			3	3									3	3
CO3			3	3									3	3
CO4			3	3									3	3
Avg.			3	3									3	3

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Aggregate Crushing value test	
Experiment No.2	Aggregate Impact value test	
Experiment No.3	Specific Gravity and Water Absorption tests	CO1
Experiment No.4	Deval's Attrition value test	
Experiment No.5	Los Angeles Abrasion value test	
Experiment No.6	Shape tests	
Experiment No.7	Penetration Test	
Experiment No.8	Ductility Test	
Experiment No.9	Softening Point Test	CO2
Experiment No.10	Flash and Fire point tests	
Experiment No.11	Viscosity test	
Experiment No.12	Marshall method	
Experiment No.13	North Dakota cone test	CO3
Experiment No.14	Swell test	
Experiment No.15	Traffic volume study at mid blocks	
Experiment No.16	Studies at intersection	
Experiment No.17	Turning movement	CO4
Experiment No.18	Spot speed studies	
Experiment No.19	Parking study	
Experiment No.20	Air pollution measurement	CO5
Experiment No.21	Noise Pollution measurement	

Learning Resources

Text Books & Reference Manuals	1. TE Lab Manual, Dept. of Civil Engg., PVPSIT. 2. HighwayEngineering,(9th edition)byKhanna, S.K.andJusto,C.E.G.,NemChand Bros,Roorkee,2010. 3. TrafficEngineeringand TransportationPlanning,(7th edition)by Kadiyali, L.R.,

	KhannaPublishers,NewDelhi,2010.
	4. SpecificationsforRoadsand Bridges-ManualforMaintenanceofroads, Most Publications,1976.
Reference Books	1.FundamentalsofTransportationEngineering,(3rdedition)byPapacostas,C.S., PrenticeHallofIndiaPvt.Ltd, NewDelhi,2009. 2.PrinciplesofHighwayEngineeringbyKadiyali,L.R.,KhannaPublishers,NewDelhi, 2012. 3.TrafficPlanningandDesignbySaxena,DhanpatRai Publishers, NewDelhi,2010. 4. TransportationEngineering-AnIntroduction,(3rdedition)by JotinKhisty.C,PrenticeHall, EnglewoodCliffs,NewJersey, 2012.
e- Resources & other digital material	http://nptel.ac.in/courses.php http://jntuk-coeerd.in/

19CE357 - SURVEY CAMP

Course Category:	Program Core		Credits:		2
Course Type:	Project		Lecture-Tutorial-Practical:		0-0-0
Prerequisites:	19CE3306 – Surveying 19CE3352 – Survey Lab		Continuous Evaluation:		75
			Semester End Evaluation:		-
			Total Marks:		75

Course Outcomes

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

CO1	Familiar with advanced survey instruments like Auto Level and Total Station.	K2
CO2	Apply modern surveying techniques in field to establish horizontal control using Total Station	K3
CO3	Understand the surveying techniques in field to establish vertical control network using Auto Level.	K2
CO4	Exposed to different survey adjustment techniques.	K4
CO5	Familiarized in mapping process	K1

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	3	2	1	1	1	1	1	3	3	2
CO2	1	1	1	1	3	2	1	1	2	1	3	1	3	2
CO3	3	2	2	1	3	3	1	2	2	1	1	2	3	2
CO4	1	1	2	1	3	2	1	1	1	3	1	1	3	2
Avg.	1	1	2	1	3	**2**	1	1	1	1	1	2	3	2

1- Low	2-Medium	3-High

Course Content

Student will learn all the technical skills required for surveying by performing major activities which includes Reconnaissance survey (safety, schedule, site visit, etc.) and Topographical survey with hands on chain traversing, theodolite traversing, details of the area using theodolite, profile levelling (L/S and C/S of roads), contouring, total station traversing on the selected study area.	CO1 CO2 CO3 CO4 CO5

VI - SEMESTER SYLLABUS

19HS1601 – ENGINEERING ECONOMICS AND MANAGEMENT

Course Category:	Humanities and Social Sciences		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	--		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	Understand the nature and Scope of Engineering Economics	K2
CO2	Use Economic analysis in the decision making	K3
CO3	Use various cost concepts, Break-even analysis and Marginal costing	K3
CO4	Choose best from alternative investment opportunities	K1
CO5	Prepare cost sheets suitable to specific industries.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION TO ECONOMICS** Economics, Flow in an economy, Law of Supply and Demand, Concept of Engineering Economics, Types of efficiency, definition and scope of engineering economics, Micro Economics and Macro Economics.		**CO1**
UNIT-2	**ECONOMIC ANALYSIS** Introduction, examples for simple economic analysis, marginal selection for a product/ substitution of raw material, design selection for a product, building metrical selection, process planning/ process modification. Cash flow diagrams, Present value and discounting.		**CO2**
UNIT-3	**COST ANALYSIS AND MARGINAL COSTING** Elements of costs, Opportunity cost, Life cycle cost, fixed vs. Variable costs, Explicit costs vs. Implicit costs, Recurring vs. Nonrecurring costs. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEA. Marginal Costing introduction, Application of Marginal costing in terms of cost control.		**CO3**
UNIT-4	**CAPITAL BUDGETING AND INVESTMENT FEASIBILITY STUDIES** Phases of capital budgeting, Net present value (NPV), Internal Rate of Return (IRR), Discounted payback period (DPP), Equivalent uniform annual cost (EUAC), Benefit/cost ratio (BCR). Managing Project Resources Flow, Financial Sources, Project Cost Capital & Operating, Return on investment (ROI), Project Feasibility studies, Project Evaluation.		**CO4**
UNIT-5	**PROJECT COSTING FOR SPECIFIC INDUSTRIES** Project Cost Reduction methods, Projects Procurement Process, Project Stores, Computerization. Methods of Costing - Unit costing, job costing, and process costing		**CO5**

Learning Resources

Text Books	3. Pillai and Menon, Reinforced Concrete Design, 3/e, Tata McGraw Hill, 2017. 4. A.K. Jain, Reinforced Concrete – Limit State Design, 7/e, Standard book house, 2012.
Reference Books	3. P.C. Varghese, Limit State Design of Reinforced Concrete, 2/e, Prentice Hall of India, 2013. 4. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University, 2014.
e-Resources& other digital material	3. https://nptel.ac.in/courses/105105105/1 4. https://nptel.ac.in/downloads/105105104/

19CE3601 – DESIGN OF STEEL STRUCTURES

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3501- Structural Analysis		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Demonstrate** the knowledge of steel design philosophies, by working and limit state methodology and design bolted connections by limit state method	K2
CO2	**Analyze** and **design** both concentric and eccentric welded connections by limit state method.	K4
CO3	**Analyze** and **design** tension members inclusive of lug angle by limit state method.	K4
CO4	**Analyze** and **design** both concentric and eccentrically loaded compression members by limit state method.	K4
CO5	**Analyze** and **design** both laterally supported & unsupported beams by limit state method.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**GENERAL** Fundamental concepts of design of structures, Types of structural steel – Mechanical properties of structural steel, Indian standard rolled steel sections, Design process, Steel Structural systems, Loads & load combinations, Concept of Working stress and limit state method of design. **BOLTED CONNECTIONS** Types of fasteners, Bolts & Bolted Connection, Failure of a joint, strength and efficiency of a joint, Design of lap joint, butt joint and eccentric connections.	CO1
UNIT-2	**WELDED CONNECTIONS** Types of welds, stresses in welds, design of butt welded and Fillet welded joints subjected to axial load, eccentric welded connections.	CO2
UNIT-3	**TENSION MEMBERS** Types of tension members and sections, behaviour of tension members, Modes of failures, net effective sectional area for plates and angle sections, design of tension members using plates, single angles and double angles, lug angles.	CO3
UNIT-4	**COMPRESSION MEMBERS** Types of compression members and sections, Behaviour and failures of Compression members, Effective length, radius of gyration and slenderness of compression members, design compressive stresses in compression, design of struts, design of axially loaded compression members, built up compression members (I section and two channels) laced and battened columns, design of eccentrically loaded columns.	CO4
UNIT-5	**BEAMS** Introduction, Types of steel beam sections, Classifications of sections, lateral stability of beams, factors affecting lateral stability, behaviour of simple beams in bending, design strength of laterally supported & unsupported beams, design of laterally supported and unsupported beams.	CO5

Learning Resources

Text Books	1. S.K. Duggal, Limit state Design of steel structures, 2/e, Tata McGraw Hill, 2017. 2. N. Subramanyam, Design of Steel Structures, 2/e, Oxford University Press, 2016.
Reference Books	1. .L. Shah and Veena Gore, Limit State Design of steel structures IS:800-2007, Structures Publications, 3/e, 2012. 2. M.L. Gambhir, Fundamentals of Structural Steel Design, McGraw Hill Education, 2013. 3. Ramachandra and V. Gehlot, Design of Steel Structures, 2/e, Scientific Publishers, 2015. 4. Shiyekar M R, Limit State Design in Structural Steel, 3/e, Prentice Hall of India Pvt Ltd, 2017.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105106112/3 2. https://lecturenotes.in/subject/161/design-of-steel-structure-dss 3. https://nptel.ac.in/courses/105/105/105105162/ 4. http://www.nptelvideos.in/2012/11/design-of-steel-structures.html 5. https://freevideolectures.com/course/2679/design-of-steel-structures

19CE4601A – ADVANCED STRUCTURAL ANALYSIS

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3501- Structural Analysis		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Analyze** the three hinged and two hinged arches for concentrated and uniformly distributed loads	K4
CO2	**Analyze** the statically indeterminate frames using Moment distribution method and Kani's method	K4
CO3	**Develop** Influence line diagrams for all stress resultants in determinate beams and evaluate absolute SF, BM in the beams for moving loads.	K6
CO4	**Analyze** cables and suspension bridges	K4
CO5	**Analyze** the fixed and continuous beams using plastic analysis.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**ARCHES** **Three hinged Arch**: Introduction, Analysis of three hinged arch, B.M, S.F and normal thrust in three-hinged arches, three hinged parabolic arch subjected to concentrated loads and uniformly distributed loads **TWO HINGED ARCHES**: Introduction, Analysis of two hinged arch, B.M, S.F and normal thrust in two-hinged arches, two hinged parabolic arch subjected to concentrated loads and uniformly distributed loads.	CO1
UNIT-2	**ANALYSIS OF STATICALLY INDETERMINATE FRAMES** **Moment distribution method**: Analysis of single-storey, single bay portal frames under gravity and lateral loads. **KANI'S METHOD**: Analysis of single-storey, single bay portal frames under gravity and lateral load	CO2
UNIT-3	**INFLUENCE LINES AND MOVING LOADS** **Influence Lines**: Definition of influence line for SF, Influence line for BM-load position for maximum SF at a section-Load position for maximum BM at a section single point load, uniformly distributed load longer than the span, uniformly distributed load shorter than the span **MOVINGLOADS** Introduction, maximum SF and BM at a given section and absolute maximum S.F. and B.M due to single concentrated load U.D load longer than the span, U.D load shorter than the span, two-point loads with fixed distance between them and several point loads.	CO3

UNIT-4	**CABLES AND SUSPENSION BRIDGES** Introduction, Analysis of Cables Under Concentrated Loads and Uniformly distributed Loads, Shape of Cable under Self-Weight, Stresses in suspended Wires due to Self-Weight, Anchorage of Suspension Cables, Stiffened Bridges, Bending moment and shear force for Three Hinged Stiffened Girders, Influence Lines for B.M and S.F in Three-Hinged Stiffening Girders, Suspension Bridges with Two-hinged Stiffening Girders.	**CO4**
UNIT-5	**PLASTIC ANALYSIS** Introduction, Shape factor, Plastic Hinge, Collapse Mechanisms, Static and Kinetic Theorems, Methods of analysis, Application to Fixed and Continuous Beams.	**CO5**

Learning Resources

Text Books	1. S.S.Bhavikatti, Structural Analysis Vol.I& II, Vikas Publishing House Pvt.Ltd, 2011. 2. V.N Vazirani and M.M Ratwani, Analysis of Structures Vol-II, Khanna Publishers, 2012. 3.G.S. Pandit, S.P. Gupta, R. Gupta, Theory of Structures-Vol II, 2/e, Tata McGraw-Hill,2003.
Reference Books	1. C.K.Wang, Statically Indeterminate Structures, TataMcGrawHill, 2010. 2. R.C. Hibbeler, Structural Analysis, 6/e, Pearson, 2011.
e-Resources& other digital material	1. https://nptel.ac.in/downloads/105101085/. 2. https://nptel.ac.in/courses/105101085/4 3. https://nptel.ac.in/courses/105101085/20 4. https://nptel.ac.in/courses/105105109/pdf/m5l32.pdf

19CE4601B - ROCK MECHANICS

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3405 - Geotechnical Engineering		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the Rock properties and laboratory tests	K2
CO2	**Understand** the In-situ stresses and over coring techniques	K2
CO3	**Understand** the Shear strength and stability of rock slopes	K2
CO4	**Understand** the Wedge failure and foundations on rocks	K2
CO5	**Understand** the Grouting and numerical modelling	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	Classification of Intact rock and Rock masses, Strength and modulus from classifications. Physio mechanical properties, Laboratory tests for various physical and mechanical properties. Field shear test, Deformability tests in rock mass, State of stress in the ground.	CO1
UNIT-2	Insitu stress, various methods of stress measurement, Hydrofracturing technique, Flat jack technique, Overcoring technique. Underground opening in infinite medium, Elastic and elasto-plastic approach. Stress concentration for different shapes of opening, Zone of influence.	CO2
UNIT-3	Failure criteria for rock and rock masses, Mohr-Coulomb Yield Criterion, Drucker-Prager Criterion, Hoek-Brown Criterion, Tensile Yield Criterion. Strength and deformability of jointed rock mass, Fracture strength of jointed rock mass. Shear strength of Rock joints, Deformability of Rock joints, Concept of joint compliance.	CO3
UNIT-4	Stability of rock slopes, Modes of failure, Plane failure, Wedge failure, Circular failure, Toppling failure. Foundation on rocks, Estimation of bearing capacity, Stress distribution in rocks, Settlement in rocks, Pile foundation in rocks.	CO4
UNIT-5	Methods to improve rock mass responses, Grouting in Rocks, Rock bolting, Rock Anchors. Numerical modelling of rocks and rock masses, Application to tunnels, slopes.	CO5

Learning Resources

Text Books	1. Introduction to Rock Mechanics by R.E.Goodman, John Wiley & Sons. 2. Engineering in Rocks for Slopes, Foundation and Tunnels, Editor T. Ramamurthy, Prentice Hall India Pvt. Ltd.
Reference Books	1. Fundamentals of Rock Mechanics, Fourth Edition, by Jaeger, Cook and Zimmerman, Blackwell Publishing.

	2. Rock mechanics and the design of structures in rock, L. Obert and Wilbur I. Duvall, John Wiley & Sons, Inc
e-Resources& other digital material	1. https://nptel.ac.in/courses/105106055/ 2. http://jntuk-coeerd.in/

19CE4601C – TRAFFIC ENGINEERING

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3306 – Surveying 19CE3502 – Highway Engineering		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	Assess the characteristics of traffic and measurement	K5
CO2	Understand the importance of Level of Service and Capacity	K2
CO3	Study in details about the parking standards and traffic control	K1
CO4	Understand the importance of traffic environment and signs	K2
CO5	Study about road marking and highway safety	K1

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**TRAFFIC CHARACTERISTICS** Basic characteristics of Traffic- Volume, Speed and Density- Relationship among Traffic parameters. **TRAFFIC MEASUREMENT** Traffic Volume Studies- Types of Volume Studies –Concept of PCU- Data Collection and Presentation – Speed Studies – Types of Speeds- Methods of Conducting speed studies	CO1
UNIT-2	**HIGHWAY CAPACITY** Definition of Capacity – Importance of capacity – Factors affecting Capacity-Concept of Level of Service- Different Levels of Service **TRAFFIC REGULATION** Traffic laws, Regulation of speed, Regulation of vehicles, Regulation concerning driver, Regulation concerning traffic.	CO2
UNIT-3	**PARKING STUDIES** Types of parking facilities – On street and Off-Street Parking Facilities- Analysis of Parking Data and parking characteristics-Multi Story Car Parking Facility **TRAFFIC CONTROL** Traffic Problems in Urban areas- Importance of Traffic Control and regulation.	CO3
UNIT-4	**TRAFFIC & ENVIRONMENT** Air Pollution – Measures to reduce Air Pollution due to Traffic- Noise Pollution – Measures to reduce Noise Pollution. **TRAFFIC SIGNS** Types of Traffic Signs- cautionary, Regulatory and Informative Signs-Specifications	CO4
UNIT-5	**ROAD MARKINGS** Pavement markings- Types of Markings – Lane markings and Object markings **HIGHWAY SAFETY** Problem of Highway Safety – Types of Road accidents- Causes – Engineering	CO5

	Measures to reduce Accidents- Enforcement Measures – Educational Measures-Road Safety Audit.	
	Learning Resources	
Text Books	1. Traffic Engineering and Transportation planning, (2nd edition) by Kadiyali, L.K., Khanna publishers, 1983. 2. Highway Engineering and Traffic Analysis, (3rdedition) by Mannering and Kilareski, John wiley Publications, 2007.	
Reference Books	1. Transportation Engineering by Khisty, C. J., Prentice Hall 1986. 2. Principles of Transportation Engineering by ParthaChakroborthy, AnimeshDas.Prentice Hall, India, 2004. 3. Fundamentals of Transportation Engineering by Papacostas, C.S.,Prentice Hall, India, 1987.	
e-Resources& other digital material		

19CE4601D -HYDROPOWER ENGINEERING

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		2-1-0
Prerequisites:	19CE3302 - Fluid mechanics 19CE3301 - Engineering mechanics 19CE4501D - Hydraulic machines 19BS1204 - Applied physics		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Differentiate** various power plants	K4
CO2	**Calculate** the efficiency of hydro power plants	K3
CO3	**Understand** the requirements and components of power plants	K2
CO4	**Understand** the problems involved in the water supply to the plants	K2
CO5	**Know** the advantages and components of the power house	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-Hig2h

Course Content

UNIT-1	**PUMPED STORAGE POWER PLANT:** Classification of Hydropower Plants – Advantages of Pumped storage plants – Reversible Pump turbines – Power duration curves – Problems of operation – Numerical Problems.	CO1
UNIT-2	**ELECTRICAL LOAD ON HYDRAULIC TURBINES:** Load curve – Load factor – Power factor – Capacity factor– Utilization factor - Load duration curve – Firm power and Secondary power – Numerical Problems.	CO2
UNIT-3	**PENSTOCKS AND ACCESSORIES:** Classification of Penstocks – Design criteria for Penstocks – Economical Diameter of Penstocks – Anchor Blocks – Conduit Valves.	CO3
UNIT-4	**WATER HAMMER AND SURGE:** Water Hammer – Resonance in Penstocks – Channel Surges – Surge Tanks.	CO4
UNIT-5	**PLANNING OF POWER HOUSES:** Power house Structure – Types of Underground Power Stations – Advantages and Components of Underground Power house – Types of Layouts.	CO5

Learning Resources

Text Books	1. M.M.Dandekar and K.N.Sharma, Water Power Engineering, Vikas Publications, New Delhi. 2. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines, Standard Book House, Delhi
Reference Books	1. A.K. Jain, Fluid Mechanics, 12/e, Khanna publishers, Delhi 2. Rajput .R.K, "Fluid Mechanics and Hydraulic Machines", S.Chand and Company Ltd 3. M. Franck White, Fluid Mechanics, Tata McGraw Hill, 2017. 4. K. Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2001.

e-Resources& other digital material	1. http://www.digimat.in/nptel/courses/video/108105058/L10.html https://nptel.ac.in/content/storage2/courses/108108078/pdf/chap5/teach_slides05.pdf

19CE4601E – SANITARY ENGINEERING

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3404- Environmental Engineering 19BS1103- Chemistry of Materials		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	Understand the different sewerage systems and the types of sewerage appurtenances	K4
CO2	Analyze the characteristics of sewage	K3
CO3	Treat the sewage by using various treatment units before disposal	K4
CO4	Identify the miscellaneous methods for treatment of sewage	K2
CO5	Understand sanitary Installations and disposal techniques of the sewage	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-Hig2h**

Course Content

UNIT-1	**INTRODUCTION TO SANITARY ENGINEERING:** Sanitation, conservancy and water carriage system, sewerage systems, relative merits. **SANITARY SEWAGE AND STORM SEWAGE:** Quantity of sanitary sewage, factors affecting sanitary sewage, determination of quantity of sanitary sewage, factors affecting storm water sewage, determination of quantity of storm water sewage, sewers, sewer appurtenances, sewage pumping, types of sewers, design of sewers, construction; testing, sewer appurtenances manholes, drop man holes, lamp holes, flushing tanks, grease and oil traps, inverted siphons, street inlets, catch basins, storm water regulators, sewage pumping, types of pumps.	CO1
UNIT-2	**QUALITY AND CHARACTERISTICS OF SEWAGE:** Characteristics of sewage, decomposition of sewage, BOD, COD, physical and chemical analysis of sewage. **NATURAL METHODS OF WASTEWATER DISPOSAL:** Trickling filters and ASP trickling filters, operational problems and remedies, activated sludge process vs trickling filter process, methods of aeration, diffused air system, mechanical aeration, combined system, sludge bulking, sludge volume index.	CO2
UNIT-3	**PRIMARY TREATMENT OF SEWAGE:** Screens, grit chamber, grease traps, skimming tanks, sedimentation tanks. **SECONDARY TREATMENT OF SEWAGE:** Sanitary requirements and maintenance of the public utility services like schools, hospitals, offices and in other public buildings.	CO3

UNIT-4	**MISCELLANEOUS METHODS OF SEWAGE TREATMENT:** Septic tank, septic tank effluent disposal, Imhoff tank introduction, oxidation ditch, stabilization pond (oxidation pond) **TYPES OF LAGOONS AND RBC:** Aerobic lagoons, anaerobic lagoons, facultative ponds, Rotating Biological Contractor. (RBC)	**CO4**
UNIT-5	**SLUDGE TREATMENT AND DISPOSAL:** Anaerobic sludge digestion process, factors effecting sludge digestion, sludge digestion tanks, high-rate digestion, sludge thickening, sludge conditioning, methods of dewatering the sludge, methods of sludge disposal **SANITARY INSTALLATIONS:** Sanitary fittings, plumbing systems, single stack system, one pipe and two pipe systems, design of building drainage, maintenance of sanitary installations	**CO5**

Learning Resources

Text Books	1. .K.Garg, Environmental Engineering vol-II Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2008. 2.K.N. Duggal, Elements of Public Health Engineering,4/e, S Chand, 1988
Reference Books	1.S.C. Rangwala, Water Supply and Sanitary Engineering,1/e, Charotar, 2005. 2.S.R. Kshirasagar, Sewage and Sewage Treatment, 3/e, Roorkee Publishing House, 1968. 3.Met Calf and Eddy, Wastewater Engineering Treatment, Disposal and Reuse,Tata McGraw Hill, 2010. 4.M.J. Hammer, Water and Wastewater Technology, 2/e,John Wiley and Sons,1996.
e-Resources& other digital material	https://nptel.ac.in/syllabus/105105048/

19CE3602 -WATER RESOURCES ENGINEERING

Course Category:		Program Core		Credits:		3
Course Type:		Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:		19BS1204 - Applied physics 19CE3302 - Fluid mechanics		Continuous Evaluation:		30
				Semester End Evaluation:		70
				Total Marks:		100

Course Outcomes

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

CO1	Ability to determine and analyze various components of hydrological cycle and measurement of the rainfall	K3
CO2	Capability to apply hydrograph methods to estimate runoff	K3
CO3	Ability to evaluate the ground water yield	K4
CO4	Skill to apply the various irrigation methods to the fields and apply the irrigation management practices	K3
CO5	Capability to design irrigation canals to alluvial soils	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-Hig2h

Course Content

UNIT-1	**HYDROLOGY:** Hydrologic cycle, precipitation, types of rainfall and its measurement, computation of mean depth of rainfall over an area, double mass curve; evaporation and evapo-transpiration, infiltration, infiltration indices W-index, ø - index.	CO1
UNIT-2	**Hydrograph Analysis:** Runoff, methods of determination of runoff, Total runoff hydrograph, base flow separation, Unit hydrograph theory, derivation, applications of unit hydrograph, hydrograph of different durations, S- curve hydrograph.	CO2
UNIT-3	**Ground Water Hydrology:** Types of aquifers, Aquifer parameters, Darcy's law, well hydraulics, steady radial flow to wells in un-confined and confined aquifers, Types of wells.	CO3
UNIT-4	**PLANT WATER RELATIONSHIPS:** Introduction of irrigation, types of irrigation systems, methods of irrigation; soil moisture constants, depth and frequency of irrigation, water requirements of crops, duty, delta, base period and their relationship, crop seasons, factors affecting duty, consumptive use of water, irrigation efficiencies.	CO4
UNIT-5	**CANAL SYSTEMS:** Classification of irrigation canals, canal lining, regime silt theories, design of unlined canals, Kennedy's and Lacey's theories, balancing depth of canal.	CO5

Learning Resources

Text Books	1. B.C.Punmia and Pande B.B.Lal, Irrigation and Water Power Engineering, Laxmi Publications Pvt. Ltd., New Delhi 2. P.N.Modi, Irrigation, Water Resources and Water Power Engineering, Standard Book House, Delhi

	3. Jayarami Reddy P., Engineering Hydrology, Laxmi Publications Pvt. Ltd., (2013), Delhi
Reference Books	1. S.K.Garg, Irrigation Engineering, and Hydraulic Structures, Khanna Publishers, Delhi.
	2. K.R. Arora, Irrigation, Water Power and Water Resources Engineering, Standard Book Publishing, Delhi
	3. Subramanya K., Engineering Hydrology, Tata McGraw-Hill Education Pvt Ltd, (2013), Delhi
	4. Chow V.T., D.R Maidment and L.W. Mays, Applied hydrology, Tata McGraw Hill Education Pvt Ltd, (2011), Delhi.
	5. Mays L.W, Water Resources Engineering, Wiley India Pvt. Ltd, (2013)
e-Resources& other digital material	1. https://nptel.ac.in/courses/105105110/
	2. http://www.nptelvideos.in/2012/11/water-resources-engineering.html

19CE4602A –ADVANCED DESIGN OF REINFORCED CONCRETE STRUCTURES

Course Category:	Program Elective		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19CE35031- Design of Reinforced design of Structures		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Analyze** and **design** staircases spanning transversely and longitudinally.	K4
CO2	**Analyze** and **design** cantilever and counterfort retaining walls.	K4
CO3	**Analyze** and **design** of flat slabs as per IS:456-2000.	K4
CO4	**Analyze** and **design** of water tanks as per IS:3370-2009.	K4
CO5	**Analyze** and **design** reinforced concrete solid slab bridges as per latest IRC codes.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-Hig2h**

Course Content

UNIT-1	**DESIGN OF STAIRCASES:** Introduction, Principles of Design, Applied Loads, Design of Stairs Spanning Transversely (Horizontally) and Stairs spanning Longitudinally.	**CO1**
UNIT-2	**RETAINING WALLS:** Types of retaining walls, forces on retaining walls, stability requirements, Preliminary proportioning of cantilever/counterfort retaining walls, Design of cantilever and counterfort retaining walls.	**CO2**
UNIT-3	**DESIGN OF FLAT SLABS:** Direct Design Method – Distribution of Moments in column strips and middle strip – moment and shear transfer from slabs to columns – shear in flat slabs – check for one way shear – Introduction to equivalent frame method. Limitation of direct design method – Distribution of moments in column strips and middle strip.	**CO3**
UNIT-4	**DESIGN OF WATER TANKS:** Introduction, Design Requirement, Methods of Analysis, Design of Circular tanks resting on ground, Design constants, rectangular tanks resting on ground.	**CO4**
UNIT-5	**DESIGN OF SLAB BRIDGE** **Design loads for bridges:** Introduction, load distribution theories, Design loads-Dead load, Vehicle Live Load, Impact Effect, Wind Loading, Longitudinal forces. **Slab bridges**: Introduction, Wheel load on slabs, Effective Width Method-Slab supported on Two Edges (Simply Supported Slabs), Dispersion length, Design of slab bridges.	**CO5**

Learning Resources

Text Books	1. P.C.Varghese, Advanced Reinforced Concrete Design, 2/e, Prentice Hall of India, 2010. 2. S.S.Bhavikatti, Advance R.C.C Design(R.C.C. Volume- II), 2/e, New Age International Publishers, 2012. 3. T.R.Jagadeesh and M.A.Jayaram, Design of Bridge Structures, 2/e, Prentice

	Hall of India, 2014. P.C.Varghese, Limit State Design of Reinforced Concrete, 2/e, Prentice Hall of India, 2015.
Reference Books	Pillai and Menon, Reinforced Concrete Design, 3/e, Tata McGraw Hill, 2017.
e-Resources& other digital material	1. https://freevideolectures.com/course/2686/design-of-reinforced-concrete-structures/26 2. https://nptel.ac.in/courses/105/105/105105104/ https://freevideolectures.com/course/3269/advanced-foundation-engineering/24

19CE4602B - ADVANCED FOUNDATION ENGINEERING

Course Category:		Program Elective		Credits:		3
Course Type:		Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:		19CE3403- Geotechnical Engineering 19CE4501B – Foundation Engineering		Continuous Evaluation:		30
				Semester End Evaluation:		70
				Total Marks:		100

Course Outcomes

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

CO1	**Evaluate** the bearing capacity in layered soil.	K4
CO2	**Conduct** the settlement analysis.	K3
CO3	**Design** mat foundation in different conditions.	K6
CO4	**Design** the best suitable earth retaining structure.	K6
CO5	**Analyse** pile foundation.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-Hig2h**

Course Content

UNIT-1	**BEARING CAPACITY OF FOUNDATIONS**: Using general bearing capacity equation, Meyerhof's, Brinch Hansen's and Vesic's methods.	**CO1**
UNIT-2	**BEARING CAPACITY OF LAYERED SOILS:** Strong layer over weak layer, Weak layer on strong layer, bearing capacity of foundations on a top of slope, Bearing capacity of foundations at the edge of the slope.	**CO2**
UNIT-3	**SETTLEMENT ANALYSIS:** Immediate settlement of footings resting on granular soils, Schmertmann& Hartman method, De Beer and Martens method.	**CO3**
UNIT-4	**SETTLEMENT IN CLAYS**: Immediate settlement, Janbu's method, correction for consolidation settlement using Skempton and Bjerrum's method, Correction for construction period	**CO4**
UNIT-5	**MAT FOUNDATIONS:** Purpose and types of isolated and combined footings, Mats/ Rafts, Proportioning of footings.	**CO5**

Learning Resources

Text Books	1. Principles of Foundation Engineering, BM Das, CENTAG Learning 2. Soil Mechanics and Foundation Engineering, VNS Murthy, CBS Publishers
Reference Books	1. Foundation Analysis and Design, J.E. Bowles, John Wiley Foundation Design, W.C. Teng, Prentice Hall Publishers.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105108069/ 2. http://jntuk-coeerd.in/

19CE4602C- REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3306- Surveying		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Understanding** of aerial photographs, stereoscopy and Remote sensing sensors and platforms, their properties and calibration.	K4
CO2	**Knowledge** of Technical issues relating to the acquisition, storage, management, analysis and display of the GIS spatial data.	K4
CO3	**Understanding** of image processing sequence and its importance in Remote Sensing & Spatial Analysis.	K4
CO4	**Understanding** of GIS Map Projections and Buffering Techniques and Raster data models and vector data models.	K4
CO5	**Apply** GIS land cover and land use management, agriculture, forestry, & disaster management.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2		2		3		2		3			3	2	2
CO2	2		2		3		2		3			3	2	2
CO3	2		2		3		2		3			3	2	2
CO4	2		2		3		2		3			3	2	2
CO5	2		2		3		2		3			3	2	2

1- Low	**2-Medium**	**3-Hig2h**

Course Content

UNIT-1	**BASIC CONCEPTS AND FOUNDATION OF REMOTE SENSING** – Elements involved in Remote Sensing, Electromagnetic spectrum, remote sensing energy interactions with atmosphere, Resolution, Satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation. **PHOTOGRAMMETRY** and Types of Aerial photographs, stereoscopy, Map Vs Mosaic, ground control, Stereoscopic Parallax, Orthophotograph.	**CO1**
UNIT-2	**BASIC CONCEPT OF GIS:** Introduction, Information systems, Spatial and Non- Spatial information, Advantages of GIS, Basic Components of GIS, GIS Categories, Fundamental Operations of GIS, Projections of Maps, Classification of Maps.	**CO2**
UNIT-3	**DIGITAL IMAGE PROCESSING:** Basic Character of Digital Image; Pre-processing, Geometric Correction Methods, Atmospheric correction methods, Image Registration, Image Enhancement Techniques, Spatial Filtering Techniques, Image Classifications, Supervised Classifications, Unsupervised Classifications.	**CO3**
UNIT-4	**GIS DATA REPRESENTATION:** Types of Data Representation, Data Collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and Scanning, Raster GIS, Vector GIS – File Management, Spatial Data, Non-Spatial Data – Layer Based GIS, Feature based GIS mapping, GIS Data File Management. Buffering Techniques.	**CO4**
UNIT-5	**REMOTE SENSING SYSTEM APPLICATIONS:** Advantages and disadvantages of remote sensing, land use and land cover mapping, base maps, remote sensing platforms, Flood and Drought impact	**CO5**

assessment and monitoring, geological and soil mapping, agriculture applications, forestry applications and water resources applications.

Learning Resources

Text Books	1. Remote Sensing and Geographical Information systems, (2nd edition) by Anji Reddy M.B.S. Publications, JNTU Kakinada, 2008. 2. Remote Sensing and GIS, (2nd edition) By Basudeb Bhatta Oxford Higher Education
Reference Books	1.Remote Sensing and Image Interpretation, (6th edition) by Thomas Lillesand. M and Ralph Kiefer W., 2007 2. Remote Sensing of the Environment: An Earth Resource Perspective by John R. Jensen, 2009.
e-Resources& other digital material	1. http://nptel.ac.in/courses.php 2. http://jntuk-coeerd.in/

19CE4602D -OPEN CHANNEL HYDRAULICS

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		2-1-0
Prerequisites:	19CE3302- Fluid mechanics 19BS1101- Engineering Mathematics-I		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the concept of open channels	K4
CO2	**Design** economic channel sections	K4
CO3	**Apply** gradually varied flow equation and able to solve problems	K4
CO4	**Understand** energy dissipation during hydraulic jump	K4
CO5	**Understand** the concept of flood routing	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-Hig2h

Course Content

UNIT-1	**INTRODUCTION** Types of channels, classification of flows, velocity distribution, pressure distribution, specific energy, critical depth – calculation, kinetic energy correction factor, momentum correction factor. Bottom slopes and Surface profiles.	CO1
UNIT-2	**UNIFORM FLOW:** Chezy's equation, Manning's formula, velocity distribution, uniform flow computations, hydraulically efficient channel sections, Specific Energy, Specific Force, Critical Flow, Compound channel section, Irrigation canal.	CO2
UNIT-3	**GRADUALLY VARIED FLOW (GVF):** Differential equation for GVF, classification and features of flow profiles, control sections, simple numerical solutions of GVF problems.	CO3
UNIT-4	**RAPIDLY VARIED FLOW:** Hydraulic jump in horizontal rectangular channel, use of jump as energy dissipator, Applications of hydraulic Jump. Types of hydraulic jump.	CO4
UNIT-5	**FLOOD ROUTING** through reservoirs and flood routing through channel, Muskingum method of flood routing.	CO5

Learning Resources

Text Books	1. K. Subramanya, Flow in Open Channels, 5/e, Tata McGraw Hill, 2015. 2. VenTe Chow, Open-Channel Hydraulics, McGraw-Hill, 2009.
Reference Books	1. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics and Hydraulic Machines, 20/e, Standard Book House, 2015. 2. A.K. Jain, Fluid Mechanics, 12/e, Khanna publishers, 2014.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105/103/105103096/ 2. https://nptel.ac.in/content/storage2/courses/105107059/module1/lecture1/lecture1.pdf

19CE4602E – AIR POLLUTION AND ITS CONTROL

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19MC1301- Environmental Sciences		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** of contemporary pollution issues.	K4
CO2	**Analyze** specific examples of various sources of air pollution.	K4
CO3	**Comprehend** the causes and effects of key types of air pollution.	K4
CO4	**Classify** of different pollution control strategies	K4
CO5	**Assess** the air sampling methods for safe air quality management.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-Hig2h**

Course Content

UNIT-1	**AIR POLLUTION** Air pollution - definitions-scope, significance -air pollutants -classification – natural and artificial-primary and secondary, point and non-point. EFFECT OF AIR POLLUTION Effect of air pollutants on man-material and vegetation-global effects of air pollution greenhouse effect, heat lands, acid rains and ozone.	**CO1**
UNIT-2	**METEROLOGY AND PLUME DISPERSION** Properties of atmosphere-heat, pressure, wind forces, moisture and relative humidity influence of meteorological phenomenon on air quality- wind rose diagram. **LAPSE RATE** Lapse rate, pressure systems, wind and moistures, inversions and plume behaviour, plume rise models.	**CO2**
UNIT-3	**METHODS OF CONTROLLING** Control of particulates-control at sources-controlling equipment-settling chamber centrifugal separators-fabric filters –dry and wet scrubbers-electrostatic precipitators. **GASEOUS POLLUTANTS** General Methods of Controlling Gaseous Emission-adsorption-absorption-combustion condensation-SO$_X$ control- NO$_X$ control-technologies	**CO3**
UNIT-4	**INPLANT CONTROL MEASURES** Process Change-Dry and Wet Methods of Removal and Recycling-Dust Collection Devices-Internal Separators-Catalyst Reduction	**CO4**
UNIT-5	**SAMPLING AT SOURCE** Flue Gases-Emission Standards-Gaseous Sampling. **AIR QUALITY MANAGEMENT**	**CO5**

	Air Quality Management-Monitoring of Suspended Particulate Matter, Gaseous matter. Air Act.	
Learning Resources		
Text Books	1.Air Pollution and Control by Rao, M.N and Rao, H.N., Tata McGraw Hill, New Delhi 2007. 2. Environmental Engineering and Management, (2nd Edition) by Suresh, S.K.Kartarai& Sons, 2005.	
Reference Books	1. An Introduction to Air pollution by Trivedy, R.K., B.S. Publications, 2005. 2. Air pollution by Wark and Warner, Addison-Wesley Publications, 1998.	
e-Resources& other digital material	http://nptel.ac.in	

19MC1601 - ENGINEERING ETHICS

Course Category:	Mandatory Course		Credits:	0
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** the core values that shape the ethical behaviour of an engineer and Exposed awareness on professional ethics and human values.	K2
CO2	**Understand** the basic perception of profession, professional ethics, various moral issues &uses of ethical theories.	K2
CO3	**Understand** various social issues, Industrial standards, code of ethics and role of professional ethics in engineering field.	K2
CO4	**Demonstrate** responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer.	K3
CO5	**Acquire** knowledge about various roles of engineers in variety of global issuesand able to **apply** ethical principles to resolve situations that arise in their professional lives.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**HUMAN VALUES** Morals, values and Ethics –Integrity –Work ethic –Service learning –Civic virtue –Respect for others –Living peacefully –Caring –Sharing –Honesty –Courage –Valuing time –Cooperation –Commitment –Empathy –Self-confidence –Character –Spirituality –Introduction to Yoga and meditation for professional excellence and stress management.	CO1
UNIT-2	**ENGINEERINGETHICS** Senses of „Engineering Ethics" –Variety of moral issues –Types of inquiry –Moral dilemmas –Moral Autonomy –Kohlberg"s theory –Gilligan"s theory –Consensus and Controversy –Models of professional roles –Theories about right action –Self-interest –Customs and Religion –Uses of Ethical Theories.	CO2
UNIT-3	**ENGINEERING AS SOCIAL EXPERIMENTATION** Engineering as Experimentation –Engineers as responsible Experimenters –Codes of Ethics –A Balanced Outlook on Law.	CO3
UNIT-4	**SAFETY, RESPONSIBILITIESAND RIGHTS** Safety and Risk –Assessment of Safety and Risk –Risk Benefit Analysis and Reducing Risk –Respect for Authority –Collective Bargaining –Confidentiality –Conflicts of Interest –Occupational Crime –Professional Rights –Employee Rights –Intellectual Property Rights (IPR) –Discrimination.	CO4
UNIT-5	**GLOBAL ISSUES** MultinationalCorporations–BusinessEthics-EnvironmentalEthics–ComputerEthics-Role in Technological Development–Weapons Development–	CO5

	Engineers as Managers–Consulting Engineers–Engineers as Expert Witnesses and Advisors–Honesty –Moral Leadership–Sample Code of Conduct.	
## Learning Resources	
Text Books	1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003. 2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.	
Reference Books	1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004. 2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics –Concepts and Cases", Cengage Learning, 2009	
e-Resources& other digital material	1. www.onlineethics.org 2. www.nspe.org 3. www.globalethics.org 4. www.ethics.org	

19CE3651 – ARCHITECTURAL PLANNING AND CAD LAB

Course Category:	Program Core		Credits:		1.5
Course Type:	Practical		Lecture-Tutorial-Practical:		0-0-3
Prerequisites:	19CE3404 – Construction materials and Concrete Technology 19CE3503 – Design of Reinforced Concrete Structures		Continuous Evaluation:		25
			Semester End Evaluation:		50
			Total Marks:		75

Course Outcomes

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

CO1	**Develop** the ability to draft civil engineering drawing using CAD software	K4
CO2	**Demonstrate** the knowledge of local bylaws and will be able to design the building in accordance with local regulations**.**	K3
CO3	**Design** the different types of building in accordance with climatic conditions, with environmentally responsibility and as per the requirements of the owner**.**	K4
CO4	**Create** working drawings for construction**.**	K6
CO5	**Create** detailed drawing of utilities including water supply, sanitary and electrical layout as layers**.**	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

Experiment No.1	**PRINCIPLES OF CIVIL ENGINEERING** drawing and introduction to AutoCAD, Concept of setbacks, carpet area, plinth area, floor area ratio, and floor space index, super built-up area, bubble diagram and coverage. Introduction to urban and municipal bylaws as per national building codes.	CO1, CO2
Experiment No.2	**Foundations**: Plan and sectional elevation of Stepped wall footing, isolated R.C.C stepped and sloped footing (with Reinforcement details)	CO1
Experiment No.3	**Openings**: a. Plan and sectional elevation of Doors (Fully panelled, half panelled, flush) 　　　　b. Plan and sectional elevation of Windows (Fully panelled, half panelled, glazed)	CO3
Experiment No.4	Concept of plan, elevation, cross section, schedule of opening and site plan of a single bed residential building	CO3
Experiment No.5	Concept of plan, elevation, cross section, schedule of opening and site plan of a single bed residential building	CO3
Experiment No.6	Development of plan, elevation and section of building from single line diagram.	CO3
Experiment No.7	Space design of a apartment building using circulation diagram satisfying the given requirement.	CO3
Experiment No.8	Space design of a primary health Centre.	CO3
Experiment No.9	Space design of a educational building.	CO3
Experiment No.10	Space design office building.	CO3
Experiment No.11	Space design of post office and bank building.	CO3
Experiment No.12	Development of water supply, sanitary and electrical drawing for a given residential building as a layer.	CO5
Experiment No.13	Development of center line drawing for a storied building- footing,	CO4

	column, beam locations.	
	## Learning Resources	
Text Books & Reference Manuals	1. Shah M.H and Kale C.M,"Building Drawing", Tata Mc Graw Hill Publishing co. Ltd., New Delhi 2. Gurucharan Singh and Subash Chander, "Civil Engineering Drawing". (2014), English Standard Publishers and Dist., Delhi. N. Chakraborti, "Civil Engineering Drawing", 2004, Bhaktivedanta Book Trust, Kolkata.	
Reference Books	1. Shah M H and Kale C M, "Building drawing", Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi. 2. 2. Gurucharan Singh, "Building Construction", Standard publishers and distributors, NewDelhi. 3. National Building Code, BIS, New Delhi. 4. Sham Tickoo, "Understanding AUTOCAD 2004 A beginner's Guide", Wiley Dreamtech India Pvt Ltd. Jayaram M A., Rajendra Prasad D S., "A referral on CAD Laboratory", Sapna Publications.Pvt. Ltd	
e- Resources & other digital material	http://nptel.ac.in/courses.php http://jntuk-coeerd.in/	

VII - SEMESTER SYLLABUS

19HS1703- CONSTRUCTION MANAGEMENT

Course Category:	Humanities Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3404- Construction materials and Concrete Technology		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Knowledge** on different methods of planning, scheduling and controlling and Work break down structure	K2
CO2	A complete i**dea** on developing time estimates and problems on network analysis.	K2
CO3	**Understanding** of cost analysis and resource allocation and scheduling	K2
CO4	An **idea** on construction management, safety and roles of different stake holders	K2
CO5	**Knowledge** on types of organization and related policies and acts	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Introduction to Construction Management :**Introduction : Origin of PERT and CPM, Planning, Scheduling and controlling, Bar Charts, Milestone charts, weaknesses in Bar charts, PERT and CPM networks and Problems, Comparison, Event, Activity, Rules for drawing networks Numbering the events (Fulkerson's law), Dummy activities, Work Break-down structure.	CO1.
UNIT-2	**CPM-PERT-Network Analysis:** Time estimate-Expected time, Earliest allowable occurrence time, Latest allowable occurrence time, slack and Problems, Problems on Network Analysis, project duration, probability of completion, Start and Finish time estimates, Floats and Problems, Project scheduling, Critical and sub-critical path. Updating – Process of updating; when to update	CO2.
UNIT-3	**CPM Cost Model & Resources allocations, resource scheduling:** Cost Analysis; direct and indirect costs, operation time, Normal and crash times and costs, Problems on cost analysis, Optimizing project cost, crash limit, Free float limit, Optimization Resource smoothening. Resource levelling.	CO3
UNIT-4	**Management:** Scope of Construction Management; Significance of Construction Management, Concept of Scientific Management; Safety in Construction, Qualities of Manager; The roles/functions performed by effective and competent Managers, The Manager: i) as a decision maker; ii) as a motivator; iii) as a communication-link; iv) as a conflict resolver; v) as a well – wisher of co-employees and the employer; etc Role play with roles of different stakeholders of construction industry.	CO4
UNIT-5	**Organization –** Types of organization; Merits and demerits of different types of organization – Authority –Policy– Labour Problems; Labour Legislation in India; 'Workmen's compensation Act of 1923 and Minimum Wages Act of 1948', and subsequent	CO5

	amendments.

Learning Resources

Text Books	1. Dr. B. C. Punmia and K. K. Khandelwal, Project Planning and Control with PERT and CPM, 4/e, Laxmi Publications, 2016 2. Kumar Neeraj Jha, Construction Project Management: Theory and Practices, 2/e, Pearson Education, 2015
Reference Books	1. Dr. P. N. Modi, Rajeev Modi, PERT and CPM - Project Evaluation Review Technique and Critical Path Method, 5/e, Standard Book House, 2012. 2. L S Srinath, PERT and CPM Principles and Applications, 3/e, Affiliated East-West Press, 2001. 3. U.K. Shrivastava, Construction Planning and Management, 2/e, Galgotia Publications- New Delhi, 2000. 4. Kerzner H., Project Management- A systems approach to planning, scheduling and controlling, 10/e, John Wiley & Sons, Inc., New Jersey, USA, 2009.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105104161/ 2. http://jntuk-coeerd.in/

19CE3701 – ESTIMATION & COSTING

Course Category:	Program Core		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3303 - Surveying 19CE3651 - Architectural planning & CAD Lab		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** drawings, principles of different works in civil engineering, approximate methods of estimating and standard specifications for different items of works in buildings	K2
CO2	**Prepare** detailed estimates for buildings using a long wall short wall method and centre line method	K2
CO3	**Develop** the preparation of rate analysis for different works in civil engineering and understand the reinforcement bar bending schedules	K6
CO4	**Understand** procedures of contracts and valuation	K2
CO5	**Calculate** earthwork for roads & canals and prepare reports on estimates for the construction of buildings and roads.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION TO ESTIMATION** General items of work in building – Principle of units for various items of works - working out quantities for detailed and abstract estimates – Approximate methods of estimating. **STANDARD SPECIFICATIONS** Standard specifications for different items of building construction.	CO1
UNIT-2	**LONGWALL & SHORTWALL METHOD** Detailed Estimates of Buildings using Long wall & short wall method. **CENTRE LINE METHOD** Detailed Estimates of Buildings using Centre line method.	CO2
UNIT-3	**STEEL ESTIMATION** Reinforcement bar bending and bar requirement schedules. **RATE ANALYSIS** Rate Analysis – Working out data for various items of work over head and contingent charges.	CO3
UNIT-4	**CONTRACTS** Contracts – Types of contracts – Contract Documents – Conditions of contract. **VALUATION** Valuation of buildings.	CO4
UNIT-5	**EARTH WORK FOR ROADS AND CANALS**	CO5

	Estimation of earthwork for roads and canals – Lead and Lift considerations	
	REPORTS	
	Reports on estimates for the construction of buildings and roads	

Learning Resources

Text Books	3. B.N.Dutta, Estimating and Costing, 28th edition, UBS Publishers' Distributors Pvt. Ltd, 2016. 4. G.S.Birdie, Estimating and Costing, 7th edition, Dhanpat Rai Publishing Company (P) Ltd, 2016.
Reference Books	1. A.K.Upadhyay, Civil Estimating and Costing, S.K.Kataria& Sons., 2012. 2. D.D.Kohli, Estimating and Costing, S.Chand& Company Pvt Ltd, 2013.
e-Resources& other digital material	1. https://www.services.bis.gov.in:8071/php/BIS/PublishStandards/published#

19CE4701A –ADVANCED DESIGN OF STEEL STRUCTURES

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3601 - Design of Steel Structures		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Analyze** and **design** cross section of plate girder and its connections.	K6
CO2	**Analyze** and **design** web stiffeners, web splice of plate girder.	K6
CO3	**Analyze** and **design** roof trusses and purlins.	K6
CO4	**Analyze** and **design** column bases and grillage foundation.	K6
CO5	**Analyze** and **design** gantry girder.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Plate Girders:** Components of a plate girder, economical depth, design of flanges, design of cross section of plate girders, design of connection.	CO1
UNIT-2	**Plate Girders:** Web stiffeners - design of vertical, horizontal and bearing stiffener, web splice.	CO2
UNIT-3	**Roof Trusses:** Types of trusses, economical spacing of roof trusses, loads on roof trusses, estimation of wind load on roof trusses as per IS:875, design of members of roof truss and joints, design of purlins.	CO3
UNIT-4	**Column Bases and Foundations:** Slab base, gusset base and grillage foundations for axially loaded columns.	CO4
UNIT-5	**Gantry Girder:** Introduction - loading consideration and maximum load effect - selection of gantry girder – design of gantry girders for primary loads only.	CO5

Learning Resources

Text Books	1. S.K. Duggal, Limit state Design of steel structures, 2/e, Tata McGraw Hill, 2017. 2. N. Subramanyam, Design of Steel Structures, 2/e, Oxford University Press, 2016.
Reference Books	1. V.L. Shah and Veena Gore, Limit State Design of steel structures IS:800-2007, Structures Publications, 2012. 2. M.L. Gambhir, Fundamentals of Structural Steel Design, McGraw Hill Education, 2013. 3. Ramachandra and V. Gehlot, Design of Steel Structures, 2/e, Scientific Publishers, 2015.

e-Resources& other digital material	1. https://freevideolectures.com/course/2679/design-of-steel-structures/38
	2. http://nptelvideos.com/video.php?id=1655
	3. https://www.digimat.in/nptel/courses/video/105103094/L36.html
	4. http://www.nptelvideos.in/2012/11/design-of-steel-structures.html-

19CE4701B - SOIL DYNAMICS AND MACHINE FOUNDATIONS

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3403-Geotechnical Engineering		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the concept of damping and SHM.	K2
CO2	**Analyze** the vibration.	K4
CO3	**Understand** wave theory and dynamic properties of soils.	K2
CO4	**Design** the best suitable machine foundation.	K6
CO5	**Understand** the types of vibration isolation.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Introduction:** Types of motion, SHM, Fundamental definitions, SDOF systems, Free and forced vibration with and without damping, Constant force and rotating mass type excitation. **Damping:** Types of damping, Equivalent stiffness of springs in series and parallel, Resonance and its effect, magnification-logarithmic decrement, Transmissibility.	CO1
UNIT-2	**Vibration Analysis:** Theories of Vibration Analysis, EHS Theory and lumped parameter model, Different modes of vibration, Natural frequency of foundation soil system, Barkan and IS methods. Pressure bulb concept, Reisner Theory, Limitations of Reisner theory, Sung's solutions, Pauw's Analogy, Heigh's Theory.	CO2
UNIT-3	**Dynamic properties:** of soils, Determination of E, G and Poisons ratio from field and laboratory tests, recommendations of Indian codes, Stress waves in bounded elastic medium. **Wave theory:** Use of wave theory in the determination of elastic properties, Elastic coefficients of soils and their determination- damping factor from free and forced vibration tests, Block vibration test, Determination of Damping factor.	CO3
UNIT-4	**Machine foundations:** Types of machine foundations, general requirements design, criteria for machine foundations, permissible amplitudes and bearing pressure Design data. **Design:** Design criteria, IS code provisions for the design foundations of reciprocating machines.	CO4
UNIT-5	**Vibration Isolation:** Transmissibility, Principles of isolation, Methods of isolation Vibration isolators, Types and their characterizes. **Special Topics:** Liquefaction of soils, CSR, CRR, Factor of safety against liquefaction, Dynamic bearing capacity, Earth retaining structures under dynamic loads.	CO5

	Learning Resources
Text Books	1. Soil Mechanics and Machine foundations, Swami Saran, Galgotia Publications. 2. Fundamentals of Soil Dynamics, B M Das, Centage Learning
Reference Books	1. Vibrations of Soils and Foundations, Richart Hall and Woods 2. Vibration Analysis and Foundation Dynamics, NSV Kameswara Rao, Wheeler Publishing, New Delhi. 3. Foundations of Machines- Analysis and Design, Prakash and Puri 4. Analysis and design of Foundations for Vibrations, P J Moore 5. Dynamics of bases and Foundations, D DBarkar
e-Resources& other digital material	1. https://nptel.ac.in/courses/ 105101005/ 2. http://jntuk-coeerd.in/

19CE4701C – TRANSPORTATION INFRASTUCTURE ENGINEERING

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19BS1101- Engineering Mathematics - I 19CE3502 - Highway Engineering		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Comprehend** the sleepers, ballast and rail joints of railways	K2
CO2	**Study** the signalling and railway station	K2
CO3	**Study** the airport planning, lighting and marking	K2
CO4	**Understand** the harbour structure and navigational aids	K2
CO5	**Comprehend** the concept of transit system and bus route network planning	K2

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2						2	1
CO2						2	2						2	1
CO3						2	2						2	1
CO4						2	2						2	1
CO5						2	2						2	1
Avg.						2	2						2	1

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Rails and Rail Joints:** Permanent way, forces acting on rails, function of rails, rail joints **Sleepers and Ballast:** Sleepers and ballast types and functions, elements of junctions and layouts	CO1
UNIT-2	**Signaling of Railways:** Objectives, classifications, signaling systems, mechanical and electrical signaling systems, systems for controlling train movement **Railway Station and Yards:** Site selection, facilities, classification, platforms, types of yards	CO2
UNIT-3	**Airport Planning:** International Civil Aviation Organization, Directorate General of Civil Aviation, Airports Authority of India; Airport planning studies: airport system plan, airport site selection **Airport Lighting & Marking:** Runway lighting, taxiway lighting; Runway and taxiway marking	CO3
UNIT-4	**Harbour Structures:** Jetties, fenders, piers, wharves **Navigational Aids:** Light houses, beacon lights, floating navigational aids, buoys, radar	CO4
UNIT-5	**Transit Systems:** Role of Transit - Types of Transit Modes - Buses - LRT, Air cushioned and Maglev System **Bus Route Network Planning:** Route Systems - Route Location, Route Structure	CO5

Learning Resources

Text Books	1.Saxena S.C. and S.P. Arora, A text book of Railway Engineering, Dhanpat Rai,

	2010.
	2. Khanna, S. K., Arora, M. G., and Jain, S. S. Airport planning and Design, Sixth Edition, Nem Chand and Bros, Roorkee, India, 2012
	3. Bindra, S.P.A Course in Docks and Harbour Engineering, Dhanpat Rai and Sons, New Delhi, India, 1992
Reference Books	1. Railway Engineering by Agarwal M.M., Prabha & Co, New Delhi, 2012.
	2. Airport Engineering by Rao G.V., Tata Mc Graw Hill, New Delhi, 1992.
	3. Dock and Harbour engineering by Oza H.P. and Oza G., Anand Chartor Publishing House Pvt , Gujarat, 2010.
e-Resources& other digital material	1. http://nptel.ac.in/courses.php
	2. http://jntuk-coeerd.in/
	3. NPTEL :: Civil Engineering - Transportation Engineering II

19CE4701D -IRRIGATION MANAGEMENT

Course Category:	Program Elective		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19CE3602-Water resources Engineering		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Understand** various approaches in irrigation management	K2
CO2	**Understand** the capability of irrigable soils and management	K2
CO3	**Societal** approach to irrigation management	K2
CO4	**Understand** the provisions of irrigation and conflict resolution	K2
CO5	**Understand** the basic concepts of integrated water management	K2

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				2	2	2						2
CO2	2	2				1	2	1						2
CO3	2	2				2	2	2						2
CO4	2	2				2	2	2						2
CO5	2	2				1	2	1						2
Avg.	2	2				2	2	2						2

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Introduction:** Need for proper management of land and water resources. Planning of irrigation projects – Inadequacies in present approaches in canal irrigation management – command area development programmes.	CO1.
UNIT-2	**Soil Management:** Classification of irrigable soils – soils-plant-water relationships – soil management. Water logging and salinity – water quality for irrigation – Reclamation of salt affected soils	CO2.
UNIT-3	**Irrigation Management:** Irrigation management – Irrigation Management Matrix – Society and irrigation –perceptions of various stake holders on irrigation system performance. Livelihood and Production Thinking Philosophy – the different approaches. Macro and precision irrigation.	CO3
UNIT-4	Participatory irrigation management – Farmer's management of irrigation system acts - conflict resolution.	CO4
UNIT-5	Legal aspects in water sharing and management – PC-CP - case studies Introduction to Integrated Water Resources Management (IWRM)**.**	CO5

Learning Resources

Text Books	1.Irrigation Theory and practice by A. M. MICHAEL Vicas publishing house pvt ltd. 2.Irrigation Water Management: Principles and Practce by Dilip Kumar Majumdar PHI Learning pvt.Ltd
Reference Books	3.Chambers R, Canal Management, Oxford IBH. 4.VVN Murthy, Land and Water Management Engineering, Kalyani Publishers.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105/102/105102159/ 2. https://nptel.ac.in/courses/126/105/126105010/

19CE4704E – SOLID AND HAZARDOUS WASTE MANAGEMENT

Course Category:	Program Elective		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19CE3404- Environmental Engineering 19BS1103- Chemistry of Materials		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Outline** the sources, composition, handling and storage of Municipal Solid Waste	K2
CO2	**Understand** the process of collection and transport of Municipal Solid Waste	K2
CO3	**Assess** the different methods involved in separation of Municipal Solid Waste	K3
CO4	**Design** the construction and operations of landfill facilities, energy recovery systems and management of leachate systems	K6
CO5	**Understand** and review the procedure for handling of different hazardous waste such as plastic, and radioactive waste	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Sources, Types and Composition Of Municipal Solid Waste** Sources- Types- Composition of Solid Waste- Effects of improper disposal of solid waste- public health effects-Types of materials recovered from MSW. **Waste Handling, Separation and Storage:** On- site handling and separation at solid waste-on - site storage of solid waste-options under Indian conditions.	CO1.
UNIT-2	**Collection Of Municipal Solid Waste**: Methods of collection-equipment- types of vehicles-man power requirement-collection routes. **Transfer And Transport of Municipal Solid Waste**: Need for Transfer Operations-Transfer Stations-Selection of Location of Transfer Station-Transport means and methods.	CO2.
UNIT-3	**Processing Techniques:** Objectives of waste processing –material separation andprocessing technologies –biological &chemical conversion technologies – methods and controls of Composting -thermal conversion technologies, energy recovery –incineration –solidification	CO3
UNIT-4	**Disposal of Solid Waste:** Disposal of Solid Waste – Sanitary land Fills- Site selection- Planning-Design and operation of Sanitary landfills- Leachate collection & treatment-composition of land fill gases.	CO4
UNIT-5	**Hazardous Waste Management-** Hazardous waste Management: Sources and classification of hazardous wastes – Storage and collection of hazardous wastes – Treatment and disposal techniques: Physical, chemical and biological - Protection of public health and the environment. Biomedical wastes – Types – Management and handling and control. Radioactive wastes- sources and types - control and management.	\CO5

	Learning Resources		
Text Books	1. Integrated Solid waste management by GoergeTchobanolous, Hilary Theisen & Samuel A. Vigil. McGraw Hill International Editions 2. Design of Land Fills and Integrated Solid waste management by AmalenduBagchi , John Wiley & Sons
Reference Books	1. CPCB Manual on solid waste Management 2. Solid waste management K.sasikumar, sanoop Gopi Krishna PHI Learning (P) Ltd. 3. Solid waste management in India by Urvashi Dhamija.
e-Resources& other digital material	1. www.nptel.ac.in/courses/120108005 2. nptel.ac.in/courses/10510605 3. https://www.coursera.org/learn/solid-waste-management

Course Category:		Program Elective		Credits:		3
Course Type:		Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:		19CE3503 – Design of Reinforced Concrete Structures		Continuous Evaluation:		30
				Semester End Evaluation:		70
				Total Marks:		100

Course Outcomes

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

CO1	**Explain** the fundamental concepts of stress analysis and systems of prestressing	K2
CO2	**Evaluate** and analyze the stresses under various conditions.	K3
CO3	**Estimate** the various losses of prestress occurring in the pressed members.	K3
CO4	**Design** and detail the prestressed concrete members subjected to flexure	K6
CO5	**Analyze** and design of end block of prestressed concrete members	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**Introduction and Systems of prestressing** **Introduction:** Basic concepts of prestressing, Historical Development, Need for high strength steel and concrete, Terminology, Advantages of prestressed concrete, Applications of prestressed concrete. **Systems of prestressing** : Classification of prestressed concrete. Pre tensioning techniques - long line system (Hoyer system), post - tensioning Techniques (a) Fressinet system and (b) Gifford Udall system.	CO1
UNIT-2	**Analysis of prestress and Bending stresses** Basic assumptions, Analysis of prestress, Resultant stresses at a section, Pressure line or thrust line and internal resisting couple, Concept of load balancing, Stresses in tendons, Cracking moment.	CO2
UNIT-3	**Losses of Prestress** Nature of losses of Prestress, Loss due to elastic deformation of concrete, Loss due to shrinkage of concrete, Loss of prestress due to creep of concrete, Loss of prestress due to relaxation of stress in steel, Loss of prestress due to friction, Loss due to Anchorage slip, Total losses allowed for in design.	CO3
UNIT-4	**Design of prestressed concrete sections** Allowable stresses -Elastic design of simple beams having rectangular and I-section for flexure -kern lines -cable profile and cable layout.	CO4
UNIT-5	**Anchorage zone stresses in post-tensioned members** Introduction, Stress distribution in end block, Investigations on anchorage zone stresses, comparative analysis, Anchorage zone reinforcement.	CO5

Learning Resources

Text Books	3. N. Krishna Raju, Prestressed concrete, 4/e, Tata McGraw Hill, 2012. 4. G.S. Pandit, Prestressed concrete, CBS Publishers, 2014.

Reference Books	1. P. Dayaratnam, Prestressed Concrete Structures, Oxford and IBH Publishing Company, 2014. 2. T.Y. Lin, and H. Ned, Burhns, Design of Prestressed Concrete Structures, 3/e, John Wiley and Sons, 2010. 3. H. Arthur, Nilson, Design of prestressed concrete, Wiley India Pvt.ltd, 2011. 4. J.R. Libby, Modern prestressed concrete, CBS Publishers, 2007.
e-Resources& other digital material	5. https://nptel.ac.in/courses/105/106/105106118/ 6. https://freevideolectures.com/course/94/prestressed-concrete-structures 7. http://www.nptelvideos.in/2012/11/prestressed-concrete-structures.html 8. http://www.nptelvideos.com/course.php?id=337--

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3405 – Geotechnical Engineering		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the soil stabilization.	K2
CO2	**Understand** the various densification methods in-site.	K2
CO3	**Understand** the dewatering techniques.	K2
CO4	**Design** the simple earth reinforced structure.	K6
CO5	**Understand** basic knowledge about geosynthetics and grouting.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**Introduction:** Role of ground improvement in foundation engineering, methods of ground improvement, geotechnical problems in alluvial, laterite and black cotton soils. **Stabilization of Soils:** selection of suitable ground improvement techniques based on soil condition, methods of soil stabilization, mechanical, cement, lime, bitumen and polymer stabilization.	CO1
UNIT-2	**Insitu Treatment:** In situ densification methods, Insitu densification of cohesionless and consolidation of cohesive soils, dynamic compaction and consolidation. **Methods:** vibrofloation, impact at ground and at depth, Sand pile compaction, preloading with sand drains and fabric drains, stone columns, lime piles, installation techniques.	CO2
UNIT-3	**Drainage and Dewatering:** Sumps and interceptor ditches, single and multi-stage well points, vacuum and electro osmotic methods, criteria for choice of filler material around drains. **Seepage analysis:** for two-dimensional flow fully and partially penetrating slots in homogenous deposits (Simple cases only).	CO3
UNIT-4	**Earth Reinforcement:** Concept of reinforcement, types of reinforcement material, principle, components of reinforced earth. **Design principles:** of reinforced earth walls, stability checks, soil nailing and applications of reinforced earth.	CO4
UNIT-5	**Geosynthetics:** Types, geotextiles, geogrids, geomembranes, functions, properties and applications. **Grouting:** Objectives of grouting, grouts and their applications, methods of grouting, stage of grouting, post grout tests.	CO5

Learning Resources

Text Books	9. Ground Improvement Techniques, Purushotham Raj, Laxmi Publications, New Delhi. 10. Ground Improvement Techniques, Nihar Ranjan Patro, Vikas Publishing House (p) limited , New Delhi. 11. An introduction to Soil Reinforcement and Geosynthetics, G. L. Siva Kumar Babu, Universities Press.
Reference Books	1. Ground Improvement, M.P. Moseley, Blackie Academic and Professional, USA. 2. Designing with Geosynethetics, R. M Koerner, Prentice Hall
e-Resources& other digital material	1. https://nptel.ac.in/courses/105106052/ 2. http://jntuk-coeerd.in/

19CE4702C – URBAN TRANSPORTATION PLANNING

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19BS1101- Engineering Mathematics - I 19CE3502 - Highway Engineering		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Comprehend** the urban travel demand and independent variables	K2
CO2	**Analyze** the traffic surveys and trip generations modules	K4
CO3	**Assess, analyze** and study the trip distribution factors and mode choice analysis	K4
CO4	**Evaluate** the traffic assignment methods and plans	K4
CO5	**Understand** the mass transit systems and study about advance transit systems	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**URBAN TAVEL DEMAND** Urban development - Urban transport problems - Urban travel characteristics - Need for planning urban travel demand - Trends - Components of travel demand **INDEPENDENT VARIABLES** Travel Attributes - Sequential travel demand modeling - Simultaneous travel demand modeling - Study area - Cordon lines Screen lines -Zoning.	CO1
UNIT-2	**TRAVEL DEMAND SURVEYS** Sampling methods - Home interview surveys - Road side interview surveys - Terminal surveys - Cordon surveys - Taxi surveys - Onboard surveys - Economic surveys - Data checking. **TRIP GENERATION** Trip characteristics - factors influencing Trip productions and attractions - Trip rates - Zonal regression models -Category analysis - Personal trip generation models	CO2
UNIT-3	**TRIP DISTRIBUTION** Factors influencing trip distribution - Growth factor methods - Trip length frequency diagram - Growth models - LP method - Opportunity models - Gravity opportunity model. **MODE CHOICE ANAYSIS** Factors influencing passenger mode choice - Zonal regression models - Utility maximization - Binary and Multinomial Logit models - Probit arid nested Logit models.	CO3
UNIT-4	**TRAFFIC ASSIGNMENT** Need for Assignment - Diversion curves - shortest path Algorithms - All or nothing Assignment technique- Multi path Assignment - Link flows - Sufficiency and Deficiency analysis. **PLAN PREPARATION AND EVALUATION** Types of plans- conceptual plan, Master plan - short term planning vs Long term	CO4

	planning -Corridor Identification and Evaluation - Plan preparation	
UNIT-5	**MASS TRANSIT SYSTEMS** Needfor Mass Transit systems - Recommendations of Committee on urbanization & Alternate systems of UT **ADVANCE TRANSIT** Characteristics & Capacities of different MT systems - LRT**,** monorail, Metro, BRTS, etc.	CO5

Learning Resources

Text Books	1. Kadiyali L.R - Traffic Engineering and Transportation Planning -Khanna Publishers, New Delhi. 2. Papacostas C.S. - Fundamentals of Transportation Engineering Prentice Hall of India Pvt. Ltd; New Delhi. 3. John Khisty C - Transportation Engineering - An Introduction, Prentice Hall, Englewood Cliffs, New Jersey. 4. Nicholas J. Garber, A. Hoel, Raju Sarkar, Cengage learning, Principlesof Traffic and Highway Engineering..
Reference Books	1. Chari, S.R. UTP LectureNotes - Regional Engg. College, Warangal.Hutchinson, B.G. Introductionto Urban System Planning, McGraw Hill 2. Mayer M and Miller E, Urban Transportation Planning: A decision oriented Approach, McGraw Hill.Bruton, Urban Transportation Planning. 3. Dicky, Metropolitan Transportation Planning, DC Script Book Co. 4. Saxena, Traffic Planning and Design, Dhanpat Rai Publishers, New Delhi.
e-Resources& other digital material	http://nptel.ac.in/courses.php http://jntuk-coeerd.in/

19CE4702D -WATERSHED MANAGEMENT

Course Category:	Program Elective		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19MC1301-Environmental Sciences 19CE3602-Water Resources Engineering		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Understand** the concept of watershed development and approaches in India	K2
CO2	**Evaluate** the principle and estimation of soil erosion	K3
CO3	**Understand** rain water harvesting techniques	K2
CO4	**Understand** various concepts of artificial recharge	K2
CO5	**Understand** the bio mass management activities	K2

Contribution of Course Outcomes towards achievement of Program Outcomes													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1		1			1				1			2
CO2	1	1		1			1				1			1
CO3	2	2	2	2			2				2	1		2
CO4	2	2	2	2			2				2	2		2
CO5	2	2	2	2			2				2	2		2
Avg.	2	2	2	2			2				2	2		2

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**Introduction:** concept of watershed, need for watershed management, concept of Sustainable development. Hydrology of small watersheds.	CO1
UNIT-2	**Soil Management:** Principles of soil erosion, causes of soil erosion, types of soil erosion, estimation of soil erosion from small watersheds. Control of soil erosion, methods of soil conservation – structural and non-structural measures.	CO2
UNIT-3	**Water Harvesting:** Principles of water harvesting, methods of rainwater harvesting, rainwater harvesting structures, farm ponds and percolation tanks	CO3
UNIT-4	**Artificial recharge**: Artificial recharge of groundwater in small watersheds, methods of artificial recharge. Reclamation of saline soils.	CO4
UNIT-5	**Bio Mass Management:** Micro farming, biomass management- dry land agriculture, silvipasture horticulture, social forestry and afforestation- Case studies of Watershed Management.	CO5

Learning Resources

Text Books	1. Murthy, V.V.N., Land and Water Management, Khalyani Publishers.
Reference Books	1. Chatterjee, S. N., Water Resources Conservation and Management, AtlanticPublishers. 2. Muthy, J. V. S., Watershed Management, New Age InternationalPublishers. 3. Suresh Rao, Soil and Water Conservation Practices, StandardPublishers 1.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105/101/105101010/ 2. http://www.nptelvideos.in/2012/11/watershed-management.html

19CE4702E – ENVIRONMENTAL IMPACT ASSESSMENT

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3404- Environmental Engineering, 19MC1301 - Environmental Science		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand**ing of the elements of EIA and criteria for the selection of EIA methodology in different methods.	K2
CO2	**Assess** Impacts on surface water environment, air pollution sources, and suggest appropriate mitigation measures.	K3
CO3	Comprehend Impact of development activities on vegetation & wildlife and prepare environmental audit report.	K2
CO4	**Demonstrate** the options to estimate environmental laws.	K2
CO5	**Analyze** proposed development project case studies for possible environmental effects and prepare environmental impact assessment report for various industries.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION TO EIA & METHODOLOGIES:** Basic concept of EIA, Initial environmental Examination, factors affecting the EIA, Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters. Introduction, Criteria for the selection of EIA Methodology, EIA Methods, Ad-hoc methods, Network method, Environmental Media Quality Index method, Overlay methods, Cost/benefit Analysis	CO1.
UNIT-2	**PREDICTION AND ASSESSMENT OF IMPACTS ON GROUND WATER ENVIRONMENT & SURFACE WATER & SOIL & AIR POLLUTION IMPACTS:** Impact of Developmental Activities and Land use, Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. E I A in surface water, Air pollution. Methodology for the assessment of Impacts on surface water environment, Air pollution sources. Generalized approach for Assessment of Air Pollution Impacts.	CO2.
UNIT-3	**DEFORESTATION & ENVIRONMENTAL AUDIT:** Assessment of Impact of development Activities on Vegetation and wildlife, Environmental Impact of Deforestation –Causes and effects of deforestation. Environmental Audit and objectives & types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report.	CO3
UNIT-4	**POST AUDIT ACTIVITIES** The Environmental pollution Act, The water Act, The Air (Prevention & Control	CO4

	of Pollution Act.), Mota Act, Wild life Act.	
UNIT-5	**EIA CASE STUDIES & MANAGEMENT REQUIREMENTS FOR THE PREPARATION OF EIA OF INDUSTRIAL PROJECTS** Case studies on Land Use/ Land Cover, Development Projects for Initial Environmental Examination, Assessment of Impacts of Traffic & Transportation, and Preparation of Environmental Impact Assessment statement for various Industries.	CO5

Learning Resources

Text Books	1. Environmental Impact Assessment Methodologies by Y.Anjaneyulu, B.S. Publication, Sultan Bazar, Kakinada.
Reference Books	2. Environmental Science and Engineering, (2nd edition) by Glynn, J. and Gary, W. Hein Ke., Prentice Hall Publishers, 1996.
e-Resources& other digital material	1. Environmental Science and Engineering by Suresh, K. Dhaneja S.K. Katania& Sons Publication, New Delhi.

19CE3751- COMPUTER APPLICATIONS IN CIVIL ENGINEERING LAB

Course Category:	Program Core		Credits:		1.5
Course Type:	Laboratory		Lecture-Tutorial-Practical:		0-0-3
Prerequisites:	Nil		Continuous Evaluation:		25
			Semester End Evaluation:		50
			Total Marks:		75

Course Outcomes

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

CO1	**Explore** and **evaluate** open-source software applications in civil engineering	K4
CO2	**Analyse** and design structural elements using STAAD Software	K2
CO3	**Analyse** Geo spatial data and create maps and reports using GIS Software	K3
CO4	**Plan**, schedule and allocate resources for projects using Project management software	K3
CO5	Control time schedules and generate reports using Project management software	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				2									
CO2	2	2		2	2									
CO3	2	2		2	2									
CO4	2	2		2	2									
Avg.	2	2		2	2									

1- Low	2-Medium	3-High

Course Content

Experiment No.1	Introduction to various computer applications in Civil Engineering, Listing out various open source software's available. Download and explore any one open source software in related to civil engineering application and prepare a report and record the same.	CO1
Experiment No.2	List of Analysis or Design to be performed using Various software STAAD.Pro 1. Introduction to STAAD Pro software and basic beam analysis. 2. Analysis and design of structures subjected to wind and earthquake loads. (minimum five storey), Typical detailing of structural elements. 3. Analysis and design of steel truss.	CO2
Experiment No.3	List of experiments to be performed by Geographical Information System (GIS) 1. Creation and analysis of spatial data using GIS. 2. Generation of maps and reports based on specific queries. 3. Simple applications of GIS in water Resources Engineering & Transportation Engineering	CO3
Experiment No.4	List of experiments to be performed by CONSTRUCTION MANAGEMENT APPLICATIONS (either using PRIMAVERA or MS PROJECT or any other open source software). • Planning and Scheduling of residential project using PERT and CPM Techniques. • Resource Allocation for activities of residential project	CO4
Experiment No.5	List of experiments to be performed by CONSTRUCTION MANAGEMENT APPLICATIONS (either using PRIMAVERA or MS PROJECT or any other open source software).	CO5

		• Controlling the time schedule of residential project. Generating reports for residential project	

Learning Resources

Text Books	1. Project Planning and Control with PERT and CPM by Dr. B.C. Punmia and K.K. Khadelwaal,Laxmi Publications Pvt. Ltd., New Delhi
Reference Books	1. Construction Planning and Management by P S Gahlot, B M Dhir , New Age International (P) Ltd., Publishers
e-Resources& other digital material	1. https://www.iitk.ac.in/nicee/IITK-GSDMA/EQ26.pdf 2. https://desktop.arcgis.com/en/arcmap/10.3/map/reports/creating-a-report.htm

19CE3761 – PROJECT PHASE - I

Course Category:	Program Core		Credits:		2
Course Type:	Project		Lecture-Tutorial-Practical:		0-0-4
Prerequisites:	Nil		Continuous Evaluation:		100
			Semester End Evaluation:		-
			Total Marks:		100

Course Outcomes

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

CO1	**Identify** project by literature survey and gap analysis	K2
CO2	**Conduct** the necessary investigations/studies with available data	K3
CO3	**Analyze** using design guidelines/ mathematical tools or/and software tools	K4
CO4	**Interpret** the results and **assess** the usefulness of the work to the society	K5
CO5	**Compile** and communicate effectively and gain leadership/ entrepreneurship qualities	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester. The department will appoint a project coordinator who will coordinate the following: ➢ Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries) ➢ Grouping of students (max 4 in a group) ➢ Allotment of project guides The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to. **Each group will be required to**: 1. Submit a one-page synopsis before the seminar for display on notice board. 2. Give a 30 minutes' presentation followed by 10 minutes' discussion. 3. Submit a technical write-up on the talk. At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above. The seminar presentation should include the following components of the project: ❖ Problem definition and specification¬Literature survey ❖ Broad knowledge of available techniques to solve a particular problem. Planning of the work, preparation of bar (activity) charts¬Presentation- oral and written.	CO1. CO2. CO3 CO4 CO5

19CE3771 – INDUSTRIAL TRAINING/INTERNSHIP/RESEARCH PROJECTS IN NATIONAL LABORATORIES/ACADEMIC INSTITUTIONS

Course Category:	Program Core		Credits:	2
Course Type:	Internship		Lecture-Tutorial-Practical:	0-0-0
Prerequisites:	Nil		Continuous Evaluation:	75
			Semester End Evaluation:	-
			Total Marks:	75

Course Outcomes

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

CO1	**Utilize** the domain knowledge with modern tools to **solve** real world problems	K3
CO2	**Analyse** the industrial processes involved in developing / delivering the end product / service	K4
CO3	**Extend** professional ethics, accountability and communication skills for global needs	K2
CO4	**Work** effectively as individual/member/ leader in teams, preferably in a multi-disciplinary setting	K3
CO5	**Make** use of engineering knowledge for societal sustenance	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

Internships are educational and career development opportunities, providing practical experience in a field or discipline. They are structured, short-term, supervised placements often focused around particular tasks or projects with defined timescales. An internship may be compensated, non-compensated or some time may be paid. The internship has to be meaningful and mutually beneficial to the intern and the organization. It is important that the objectives and the activities of the internship program are clearly defined and understood. Following are the intended objectives of internship training: • Will expose technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry. • Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job • Exposure to the current technological developments relevant to the subject area of training. • Experience gained from the 'Industrial Internship' in classroom will be used in classroom discussions • Create conditions conducive to quest for knowledge and its applicability on the job. • Learn to apply the technical knowledge in real industrial situations. • Gain experience in writing technical reports/projects. • Expose students to the engineer's responsibilities and ethics. • Familiarize with various materials, processes, products and their applications along with relevant aspects of quality control. • Promote academic, professional and/or personal development. • Expose the students to future employers. • Understand the social, economic and administrative considerations that influence the	CO1 CO2 CO3 CO4 CO5

working environment of industrial organizations
 Understand the psychology of the workers and their habits, attitudes and approach to problem solving.

Guidelines:
1. The student has to complete the internship for a period of 4 to 6 weeks during summer vacation between VI Semester & VII Semester.
2. The internship can be carried out in any industry / R&D Organization / Research Institute / Premier Educational Institutes like IITs, NITs and IIITs etc.
3. The registration process of internship should be completed before the commencement of IV-semester end examinations.
4. The registration process for internship involves:
    a) Students have to approach respective course coordinator with name of proposed company / organization in which they wish to carry out internship.
    b) The Department shall nominate guide to supervise the interns.
    c) Student has to obtain a no objection certificate (NOC) in the prescribed format from the department and submit the same to the respective organization.
    d) Student has to submit acceptance letter issued by the respective organization to the course coordinator.
5. The internal guide has to visit place of internship at least once during student's internship.
6. The students shall report the progress of the internship to the guide in regular intervals and seek advice.
7. After the completion of Internship, students shall submit a final report along with internship and attendance certificates to the course coordinator with the approval of internal guide.
8. The evaluation of internship shall be done during VII-Semester.
9. The student has to give a PPT presentation for duration of 10 to15 minutes in the presence of departmental evaluation committee consists of Head of the Department, Internal Guide and Two Senior Faculty from the respective departments.
10. After the successful presentation by the student, the evaluation committee recommends the result as satisfactory for the internship.
11. In case of students who have not registered for internship / not submitted the internship certificate and report, the VII-Semester result will not be declared till completion for that student.

VIII - SEMESTER SYLLABUS

19CE4801A – EARTHQUAKE ENGINEERING

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3501 - Structural Analysis 19CE3503 – Design of Reinforced Concrete Structures		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Illustrate** the principles of vibration with regard to single degree of freedom system for free vibration.	K3
CO2	**Demonstrate** the principles of vibration with regard to single degree of freedom system for forced vibration.	K3
CO3	**Establish** the earthquake response of linear systems	K3
CO4	**Understand** the engineering seismology	K2
CO5	**Demonstrate** the concept of ductility and corresponding detailing.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Single-Degree- of – Freedom (SDF) Systems - Equations of Motion and Free Vibration** Simple Harmonic Motion, Mass-Spring- Damper System, Equation of Motion, D'Alembert's Principle), Degrees of Freedom, Single Degree of Freedom, Mathematical Modeling, Equation of Motion for Free Vibration for Damped and Un damped System (Single Degree of Freedom System)	CO1
UNIT-2	**Single-Degree- of – Freedom (SDF) Systems - Equations of Motion and Forced Vibration** Equation of Motion for Forced Vibration for Damped and Un damped System (Single Degree of Freedom System), Logarithmic Decrement.	CO2
UNIT-3	**Earthquake Response of Linear Systems:** Earthquake excitation, Equation of motion, Response quantities, Response history, Response spectrum concept, Deformation, Pseudo-velocity, and Pseudo-acceleration, Response spectra, Peak structural response from the response spectrum, Response spectrum characteristics.	CO3
UNIT-4	**Engineering seismology** Earthquakes, Epicenter, Hypocenter and earthquake waves, Measurement of ground motion, Seismic Regions, Intensity and Isoseismal of an earthquake, Magnitude and energy of an earthquake, Consequences of earthquakes, Seismic zoning, Seismic effects on structure.	CO4
UNIT-5	**Ductile detailing of Beams as per IS 13920** Ductility in Reinforced Cement Concrete Structures, Detailing Principles to ensure sufficient Ductility, Ductile detailing as per IS 13920, Longitudinal reinforcement,	CO5

	Shear reinforcement, Anchorage of reinforcement and concept of development length.	
Learning Resources
Text Books	2. Jai Krishna and Chandrasekharan, Saritha Prakasham, Elements of Earthquake Engineering, 2/e, South Asian Publishers, Dec.2000. 3. Anil K.Chopra, Dynamics of Structures, Theory and Applications to Earthquake Engineering, 4/e, Prentice Hall of India, 2011.	
Reference Books	3. Vinod Hosur, Earthquake-Resistant Design of Building Structures, 1/e, Wiley India Pvt Ltd. 2013.	
e-Resources& other digital material	2. https://nptel.ac.in/courses/105/101/105101004/	

19CE4801B - GEOSYNTHETICS

Course Category:	Program Elective		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19CE3405 - Geotechnical Engineering 19CE4705B-Ground Improvement Techniques		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	An **overview** of the evolution of new construction materials in geotechnical engineering and to initiate geosynthetic materials.	K2
CO2	**Understand** the properties geotextiles and geogrids.	K2
CO3	**Understand** the properties geomembranes and Geo-composites.	K2
CO4	**Use** geosynthetics on roads and **design** criteria.	K3
CO5	**Understand** availability and advantages of natural geosynthetics.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**ROAD SAFETY TRENDS:** Road accidents, Trends, causes, Collision diagrams **ROAD SAFETY FACTORS:** Human factors, road factors, driver factors; Speed and its effect on road safety; Vehicle factors	CO1
UNIT-2	**STATISTICAL INTERPRETATION:** Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis **CRASH DATA ANALYSIS:** Black Spot Identification Methods and Investigations: Multiple linear and logistic methods	CO2
UNIT-3	**ROAD SAFETY AUDITS:** Key elements of a road safety audit, Road Safety Audits & Investigations **HAZARDOUS LOCATIONS:** Methods for identifying hazardous road locations, Relevant IRC practices	CO3
UNIT-4	**ROAD SAFETY MANAGEMENT SYSTEM:** Multi-casual dynamic systems approach to safety; Road safety improvement strategies **ELEMENTS OF A ROAD SAFETY:** Elements of a road safety plan, Safety data Needs	CO4
UNIT-5	**ENGINEERING & ENFORCEMENT MEASURES:** Preventive and speed control measures **ENGINEERING MEASURES:** Education of road users and safety drives	CO5

Learning Resources

Text Books	1. Designing with Geosynthetics by Robert M. Koerner, Prantice Hall, Eaglewood

	Cliffs, NJ 07632.
	2. 'An Introduction to Soil Reinforcement and Geosynthetics' by G.L.Sivakumar Babu (2009), Universities Press (India) Pvt. Ltd.
	3. 'Engineering with Geosynthetics', by G. Venkatappa Rao and GVS Suryanarayana Raju – Tata McGraw Hill Publishing Company Limited – New Delhi.
Reference Books	1. 'Construction and Geotechnical Engineering using Synthetic Fabries' by Robert M. Koerner and Josoph P. Welsh. John Willey and Sons, New York.
	2. 'Foundation Analysis and Design' by J.E. Bowles McGraw Hill Publications.
e-Resources& other digital material	1. https://nptel.ac.in/courses/105106055/
	2. http://jntuk-coeerd.in/

19CE4802C – ROAD SAFETY AUDITING

Course Category:	Program Elective		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19BS1101- Engineering Mathematics - I 19CE3502 - Highway Engineering		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Comprehend** the road safety trends and factors	K2
CO2	**Analyze** the traffic statistics and crash data	K4
CO3	**Assess**, **analyze** and study the road safety and hazardous locations	K4
CO4	**Evaluate** the road safety elements and management system	K5
CO5	**Understand** the Engineering, Enforcement and Educational measures	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**ROAD SAFETY TRENDS:** Road accidents, Trends, causes, Collision diagrams **ROAD SAFETY FACTORS:** Human factors, road factors, driver factors; Speed and its effect on road safety; Vehicle factors	CO1
UNIT-2	**STATISTICAL INTERPRETATION:** Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis **CRASH DATA ANALYSIS:** Black Spot Identification Methods and Investigations: Multiple linear and logistic methods	CO2
UNIT-3	**ROAD SAFETY AUDITS:** Key elements of a road safety audit, Road Safety Audits & Investigations **HAZARDOUS LOCATIONS:** Methods for identifying hazardous road locations, Relevant IRC practices	CO3
UNIT-4	**ROAD SAFETY MANAGEMENT SYSTEM:** Multi-casual dynamic systems approach to safety; Road safety improvement strategies **ELEMENTS OF A ROAD SAFETY:** Elements of a road safety plan, Safety data Needs	CO4
UNIT-5	**ENGINEERING & ENFORCEMENT MEASURES:** Preventive and speed control measures **ENGINEERING MEASURES:** Education of road users and safety drives	CO5

Learning Resources

Text Books	1. Fundamentals of Transportation Engineering, (3rd edition) by Papacostas, C.S.,

	Prentice Hall of India Pvt.Ltd, New Delhi, 2009.
	2. Principles of Highway Engineering by Kadiyali, L.R., Khanna Publishers, New Delhi, 2012.
	3. Traffic Planning and Design by Saxena, Dhanpat Rai Publishers, New Delhi, 2010
Reference Books	1. Road Traffic and Work Zone Safety Manual, National Highway Authority of India, 2012.
	2. Rune Elvik and TrulsVaa, The Handbook of Road Safety Measures, Elsevier, 2004
e-Resources& other digital material	1. http://nptel.ac.in/courses.php
	2. http://jntuk-coeerd.in/

19CE4801D -ADVANCED WATER RESOURCES ENGINEERING

Course Category:	Program Elective		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19CE3602-Water Resources Engineering		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Assess** the reservoir storage requirements and sedimentation	K3
CO2	**Design** a Gravity and its profile	K6
CO3	**Apply** the design principles of earth dams and spillways.	K3
CO4	**Apply** the design principles of diversion structures.	K3
CO5	**Arrive** at appropriate canal regulation works and outlets and apply the design principles of various cross drainage works.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Reservoir Planning:** Investigations for reservoir planning, selection of site for a reservoir, zones of storage in a reservoir, reservoir yield, mass curve and demand curve, determination of reservoir capacity, yield from a reservoir, reservoir sedimentation, control of reservoir sedimentation, useful life of a reservoir.	CO1
UNIT-2	**Gravity Dams**: Classification of dams, gravity dams: forces acting, elementary profile, safety criteria, stability analysis of gravity dam, construction joints, openings in dams-galleries, foundation treatment of gravity dam.	CO2
UNIT-3	**Earth Dams**: Types, causes for failure of earth dams, phreatic line, seepage analysis for homogeneous dams, seepage control in earth dams. **Spillways**: Essential requirements, spillway capacity, components, types of spillways and their working, profile of ogee spillway, spillway crest gates.	CO3
UNIT-4	**Diversion Head Works**: Location and components, weirs and barrages, causes of failure of weirs, design of impervious floor of weirs on permeable foundation, Bligh's, Lane's and Khosla's theories, hydraulic design of vertical drop weir	CO4
UNIT-5	**Canal Regulatory Works:**Head and cross regulators-design principles. Canal outlets, types of canal modules, proportionality, sensitivity and flexibility. **Cross Drainage Works:**Types, selection, design principles of aqueduct, siphon aqueduct.	CO5

Learning Resources

Text Books	1. B.C.Punmia and Pande B.B.Lal, Irrigation and Water Power Engineering, Laxmi Publications Pvt. Ltd., NewDelhi 2. P.N. Modi, Irrigation Water Resources and Water Power Engineering, StandardBook House,Delhi

Reference Books	1. S.K.Garg, Irrigation Engineering, and Hydraulic Structures, Khanna Publishers,Delhi
	2. Ch.SatyanarayanaMurty, Water Resources Engineering, New Age International,Delhi
	3. K.R. Arora, Irrigation, Water Power and Water Resources Engineering, StandardBook Publishing,Delhi
e-Resources& other digital material	1. https://nptel.ac.in/courses/105/105/105105110/
	2. https://nptel.ac.in/content/storage2/courses/105105110/pdf/m4l06.pdf

Course Category:	Program Elective		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19CE3404 - Environmental Engineering 19BS1103- Chemistry of Materials		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Characterize** industrial effluents	K2
CO2	**Identify** relevant pre and primary treatment options for industrial effluents and waste reduction	K2
CO3	**Review and understand** the disposal methods of different solids	K2
CO4	**Suggest** pollution control strategies for Manufacturing Industries	K3
CO5	**Suggest** pollution control strategies for Food processing Industries	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Introduction of Industrial Waste Treatment**: Principles of industrial waste management, sources of pollution, physical, chemical, organic and biological properties, effects of waste water on streams, land environment and human health.	CO1.
UNIT-2	**Waste Reduction**: Waste reduction, alternatives for raw materials, process changes, housekeeping – pre-treatment of wastes, **Pre and primary treatment**: Collection of wastes, segregation – equalization – reduction in volume and strength by other methods – theories of neutralization – equalizations and proportioning.	CO2.
UNIT-3	**Different disposal methods of different solids**: A review of the methods adopted for the removal of suspended, colloidal and dissolved organic solids, removal of inorganic solids – disposal of sludge – selection of site for the plant.	CO3
UNIT-4	**Material Manufacturing Industries:** Manufacturing processes, flow sheets, characteristics and composition of wastes including waste reduction, treatment and disposal methods of Material Industries: Paper, Steel plant, Textiles and Fertilizers.	CO4
UNIT-5	**Food Processing Industries**: Manufacturing processes, flow sheets, characteristics and composition of wastes including waste reduction, treatment and disposal methods of Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries	CO5

Learning Resources

Text Books	1. Nelson Leonard Nemerow, Industrial Waste Treatment, Butterworth-Heinemann, 2007
Reference Books	1. M.N. Rao and A.K. Datta, Industrial Waste Management, xford& IBH Publishing Co Pvt.Ltd, rd edition edition,2018
e-Resources& other digital material	1. https://nptel.ac.in/courses/105106119/36

19CE3861 – PROJECT PHASE - II

Course Category:	Program Core		Credits:		7
Course Type:	Project		Lecture-Tutorial-Practical:		0-0-14
Prerequisites:	Nil		Continuous Evaluation:		100
			Semester End Evaluation:		100
			Total Marks:		200

Course Outcomes

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

CO1	**Identify** project by literature survey and gap analysis	K2
CO2	**Conduct** the necessary investigations/studies with available data	K3
CO3	**Analyze** using design guidelines/ mathematical tools or/and software tools	K4
CO4	**Interpret** the results and **assess** the usefulness of the work to the society	K5
CO5	**Compile** and communicate effectively and gain leadership/ entrepreneurship qualities	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of project Work-I

2. Re-Allotment of internship students to project guides

3. Project monitoring at regular intervals

CO1.
CO2.
CO3
CO4
CO5

All re-grouping/re-allotment has to be completed by the 1st week of VIII semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 30 marks can be conducted after completion of five weeks. The second review for another 30 marks can be conducted after 12 weeks of instruction and End Semester Project Evaluation will be for 40 marks just before the last instructional day of the semester, Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

OPEN ELECTIVES SYLLABUS

19ES5501A – BIOTECHNOLOGY AND SOCIETY

Course Category:	Open Elective -1		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understanding** the basic concepts of advanced and emerging issues in biotechnology	K2
CO2	**Analyze**, and evaluate social and ethical issues in the conduct of biological research and application of biological knowledge	K4
CO3	**Apply** knowledge and analytical approaches in several major domains of the biological sciences that reflects a breadth and depth of understanding	K3
CO4	**Analyze** the scientific method by formulating hypotheses, proposing testable predictions and then testing to reach supportable conclusions about biological processes and systems, and articulate the relevance of modern biology to society	K4
CO5	**Apply** responsibilities to promote societal health and safety, upholding the trust given to the profession by the society	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3					3		3						
CO3	3					3								
CO4						3								
CO5						3	3							
Avg.	3					3	3	3						

1- Low	2-Medium	3-High

Course Content

UNIT-1	**HISTORY OF BIOTECHNOLOGY**, Genes (basic concepts), Genetic engineering, Tools for manipulation of genes (introduction to recombinant DNA technology), Vectors and expression systems (introduction)	CO1
UNIT-2	**INTELLECTUAL PROPERTY RIGHTS** (concepts related to drugs, genes and genomes) Recombinant DNA Debates, Biotechnology and Business, Patenting Life, Genetically Modified Foods: Risk, Regulation, and Our Food	CO2
UNIT-3	Freezing, Banking, Crossing, Eugenics, The Human Genome Project, Genetic Testing, Disability, and Discrimination, Bioethics and Medicine, From the Pill to IVF, Cloning, Stem Cells.	CO3
UNIT-4	Drugs and Designer Bodies, Biotechnology and Race, Bioprospecting and Bio colonialism	CO4
UNIT-5	Vaccines, Gene therapy, Clinical trials, Synthetic Biology and Bioterrorism, Use of biofertilizers and biopesticides for organic farming	CO5

Learning Resources

Text Books	1. Biotechnology and Society: An introduction. Hallam Stevens. University of

	Chicago Press. 2016. ISBN 022604615X, 9780226046150
Reference Books	1. W. Godbey, An Introduction to Biotechnology, The Science, Technology and Medical Applications, 1/e, Woodhead Publishing, 2014. 2. J.M. Walker and R. Rapley, Molecular Biology and Biotechnology, 5/e, Royal society of chemistry, 2009. 3. B.R.Glick, J.J.Pasternak, C.L.Patten. Molecular Biotechnology.ASM Press. 2009. ISBN-10:1555814980, ISBN-13: 978-1555814984s

19ES5501B– ELECTRICAL SAFETY

Course Category:	Open Elective -1		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the Indian power sector organization and Electricity rules, electrical safety in residential, commercial, agriculture, hazardous areas and use of fire extinguishers.	K2
CO2	**Understand** the Indian power sector organization and Electricity rules, electrical safety in residential, commercial, agriculture, hazardous areas and use of fire extinguishers.	K2
CO3	**Understand** the Indian power sector organization and Electricity rules, electrical safety in residential, commercial, agriculture, hazardous areas and use of fire extinguishers.	K2
CO4	**Understand** the Indian power sector organization and Electricity rules, electrical safety in residential, commercial, agriculture, hazardous areas and use of fire extinguishers.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION TO ELECTRICAL SAFETY:** Shocks and Their Prevention: Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, who is exposed, principles of electrical safety, approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shop.	CO1
UNIT-2	**ELECTRICAL SAFETY** in Residential, Commercial and Agricultural Installations: Wiring and fitting –Domestic appliances –water tap giving shock – shock from wet wall –fan firing shock –multi-storied building –Temporary installations – Agricultural pump installation –Do's and Don'ts for safety in the use of domestic electrical appliances.	CO1
UNIT-3	**ELECTRICAL SAFETY DURING INSTALLATION,** Testing and Commissioning, Operation and Maintenance: Preliminary preparations –safe sequence –risk of plant and equipment –safety documentation –field quality and safety -personal protective equipment –safety clearance notice –safety precautions –safeguards for operators –safety.	CO2
UNIT-4	**ELECTRICAL SAFETY DURING INSTALLATION,** Testing and Commissioning, Operation and Maintenance: Preliminary preparations –safe sequence –risk of plant and equipment –safety documentation –field quality and safety -personal protective equipment –safety clearance notice –safety precautions –safeguards for operators –safety.	CO1 CO3
UNIT-5	**ELECTRICAL SAFETY DURING INSTALLATION,** Testing and	

	Commissioning, Operation and Maintenance: Preliminary preparations –safe sequence –risk of plant and equipment –safety documentation –field quality and safety -personal protective equipment –safety clearance notice –safety precautions –safeguards for operators –safety.	CO1 CO4

Learning Resources

Text Books	1. Rao, S. and Saluja, H.L., "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, 1988.
Reference Books	1. Cooper.W.F, "Electrical safety Engineering", Newnes-Butterworth Company, 1978. 2. 2. John Codick, "Electrical safety hand book", McGraw Hill Inc., New Delhi, 2000. 3. 3. Nagrath, I.J. and Kothari, D.P., "Power System Engineering", Tata McGraw Hill, 1998. 4. 4. Wadhwa, C.L., "Electric Power Systems", New Age International, 2004

19ES5501C– FUNDAMENTALS OF CYBER LAW

Course Category:	Open Elective -1		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** the basic concepts of Section 80 of IT Act 2000, Cyber Crime, Computer Crime, Internet Theft/Fraud, Goods and Services.	K2
CO2	**Demonstrate** the basic concepts of Cognizable and Non-Cognizable Offences, Hacking, Teenage Web Vandals, Prevalence and Victimology, Consumer Protection Act.	K3
CO3	**Analyze** the concepts of Arrest for "About to Commit" an Offence Under the IT Act, A tribute to Draco, Cyber Fraud, Computer as Commodities, Consumer Complaint.	K4
CO4	**Explain** the concepts of Arrest, But No Punishment, Cyber Cheating, Theft of Intellectual Property, Restrictive and Unfair Trade practices	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2	3					2	2
CO2						2	2	3					2	2
CO3						2	2	3					2	2
CO4						2	2	3					2	2
Avg.						**2**	**2**	**3**					2	2

1- Low	2-Medium	3-High

Course Content

UNIT-1	**THE IT ACT, 2000: A CRITIQUE:** Crimes in Millennium, Section 80 of the IT Act, 2000-A Weapon or a Farce? Forgetting the Line between Cognizable and Non-Cognizable Offences, Arrest for "About to Commit" an Offence Under the IT Act, A tribute to Draco, Arrest, But No Punishment	
UNIT-2	**Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000:** Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cyber Cheating.	
UNIT-3	**Traditional Computer Crime: Early Hacker and Theft of Components:** Traditional Problems, Recognizing and Defining Computer Crime, Phreakers: Yesterday's Hackers, Hacking, Computer as Commodities, Theft of Intellectual Property.	
UNIT-4	**Identity Theft and Identity Fraud:** Typologies of Internet Theft/Fraud, Prevalence and Victimology, Physical Methods of Identity Theft.	
UNIT-5	**Protection of Cyber consumers in India:** Are Cyber consumers Covered under the Consumer Protection Act? Goods and Services, Consumer Complaint, Restrictive and Unfair Trade practices	

Learning Resources

Text Books	1. Vivek Sood, "Cyber Law Simplified", Tata McGraw Hill. 2. Marjie T. Britz, "Computer Forensics and Cyber Crime", Person.

	3. Ferrera, "Cyber Laws Texts and Cases", Cengage.
Reference Books	1. Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, 2 ndEdition,PHI,2003.
	2. Justice Yatindra Singh, " Cyber Laws", Universal Law Publishing, 1 stEdition,New Delhi, 2003.
	3. Sharma, S.R., "Dimensions Of Cyber Crime", Annual Publications Pvt. Ltd., 1st Edition, 2004.
	Augastine, Paul T.," Cyber Crimes And Legal Issues", Crecent Publishing Corporation, 2007

19ES5501D – ENVIRONMENT AND ECOLOGY

Course Category:	Open Elective -1		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19MC1301 - Environmental Science		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Integrate** information related to structure and functions of ecological units.	K3
CO2	**Analyze** and communicate the concepts of environment.	K4
CO3	**Analyze** various environmental components and demonstrate using technology.	K4
CO4	**Analyze** and evaluate policies and frame works for welfare of environment & social sustainability.	K4
CO5	**Apply** system concepts for bio-monitoring environmental issues.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2					2		2
CO2	3					2	2	3						2
CO3	3						2	3						2
CO4	3						2							2
CO5	3					2	2							2
Avg.	**3**					**2**	**2**	**3**				**2**		**2**

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**ECOLOGY:** Introduction – Biosphere, scope, organization and significance. Ecosystem concept- structure &function, Factors affecting ecosystem. Evolution: Natural Selection and its ecological significance. Population parameters- growth regulation, relationships between organisms.	CO1 CO2
UNIT-2	**NATURAL RESOURCES & MANAGEMENT:** Resource- Definition, category, concept and scarcity of resource. Forests & wild life- Global productivity & human activities (Exploitation). Land Resource- use pattern in India, soil & soil Conservation. Water resource- potentials and use with special reference to India, Concept of Integrated Water Resources Management (IWRM). Remote Sensing and GIS: Applications in conserving resources.	CO1 CO2
UNIT-3	**ENVIRONMENTAL GEOSCIENCES & COMPUTER APPLICATIONS**: Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Scale of meteorology, pressure, temperature, atmospheric stability. Graphical representation of Data, creating Database tables.	CO3
UNIT-4	**ENVIRONMENTAL POLICY, EDUCATION AND ETHICS:** Important National policies: National environmental policy, 2006 & National agricultural policy etc. Legislation: Environment Protection Act, 1986.Environmental education: Goals and objectives of environmental education. Environment awareness and action: Role of NGOs in environmental awareness. Environmental movements in India- silent valley movement, Chipko movement, Narmada BachaoAndolan, Environmental movements in the West- Green Peace.	CO4
UNIT-5	**ENVIRONMENTAL MONITORING AND MANAGEMENT:** Environmental impact analysis and EMP; Analytical approaches and instrumentation in environmental monitoring; Bio-monitoring of air pollution -	CO4 CO5

	plants as bio monitors; Bio monitoring of running water pollution. (Software's)Organic Farming and its ecological significance.	
	Learning Resources	
Text Books	1) Singh, J.S; Singh, S.P. and Gupta S.R. (2014) Ecology, Environmental Science and Conservation. S. Chand & Company Pvt. Ltd. New Delhi. 2) Sharma, P.D. (2011) Ecology and Environment (11th edition) Rastogi Publication, Meerut. 3) Bharucha, E. (2013) Text Book of Environmental Studies (2nd edition.). Universities Press, Hyderabad.	
Reference Books	1) Nobel, B.J. and Wright, R.T. (1995) Environmental Science. Prentice Hall. 2) Agarwal, S.K. (1991) Pollution Ecology. Himanshu Publication, Udaipur. 3) S.V.S.Rana, Essentials of Ecology and Environmental Science, Prentice Hall India, New Delhi, 2011.	
E-Resources & other digital material	http://nptel.ac.in	

19HS5501A – CONTEMPORARY RELEVANCE OF INDIAN EPICS

Course Category:	Open Elective -1		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

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

CO1	**Gain** preliminary understanding of various Indian epics	K2
CO2	**Develop** a deep insight into the famous epics and cultivate national consciousness	K3
CO3	**Apply** the knowledge gained to various real-life situations	K3
CO4	**Analyze** the contemporary relevance of Indian epics	K4
CO5	**Interpret** and correlate the ideals to one's own life.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							2	3						
CO2						2	2	3				2		
CO3							2	3				2		
CO4							2	3				2		
CO5						2	2	3				2		
Avg.						**2**	**2**	**3**				**2**		

1- Low		**2-Medium**		**3-High**

Course Content

UNIT-1	**DEFINITION OF THE TERM EPIC** Features of epic, Introduction to Indian epics, Characteristics of classical Indian epics, Importance of Indian epics	CO1,CO4
UNIT-2	**SALIENT FEATURES OF RAMAYANA,** Epic qualities of Ramayana, Ideals to be imbibed from the first Indian epic, Moral essence in Ramayana, Impact of Ramayana on Indian society.	CO1,CO2,CO5
UNIT-3	**MAHABHARATA,** Epic qualities of Mahabharata, Set of values to be acquired from the largest epic, Impact of Mahabharata on our culture and society.	CO1, CO5
UNIT-4	**RELEVANCE OF INDIAN** Epics to the contemporary of Indian society, Relevance Of Indian Epics to the contemporary world.	CO1,CO3,
UNIT-5	**ESSENCE OF BHAGAVAD GITA,** justification of the triumph of virtue over vice, Importance of truth and Self-sacrifice.	CO1,CO2, CO5

Learning Resources

Text Books	1. Ramayana by R. K. Narayan (Penguin) 2. Mahabharata by R. K. Narayan (Penguin) 3. Geetha darshan by Rama krisha mission
Reference Books	1. The palace of illusion- Chitra Banerjee Divakaruni 2. My Gita- DevduttPattankaik 3. Asura:tale of Vanquished- Anand Neelakantan 4. Prince of Ayodhya:Book one-Ashok k.Banker 5. The Hindus: An Alternative History- Wendy Doniger 6. Myth and Reality: Studies in the Formation of Indian Culture-D.D. Kosambi Mahabharath- William Buck

19HS5501B– INDIAN NATIONAL MOVEMENT

Course Category:	Open Elective -1		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** political, social and economic background of freedom struggle (L2)	K2
CO2	**Specify** major stages of freedom struggle and their ideological distinctions (L5)	K5
CO3	**Analyze** the role of nationalist movement in the making of modern India(L4)	K4
CO4	**Develop** an attitude of nationalism cutting across limited boundaries of religion in order to resist communal forces(L5)	K5
CO5	**Interpret** and correlate the ideals to one's own life. (L4)	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						1			1					
CO2						2			2					
CO3						2			2					
CO4						2			2					
Avg.						**2**			**2**					

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	Module -I Back ground: Early British Colonialism in India, early rebellions –Pazhassi raja (the cotiote war -Kerala, 18 th century), VeerapandiyanKattabomman (Taminadu/Madras Presedency-18th century), Paik rebellion (Kalinga/ Odisha, early 19th century), Vellore mutiny (early 19 th century); The Sepoy Mutiny of 1857 and its consequences.	CO1
UNIT-2	Module -II Contributory Factors: Socio political consciousness, growth of Western education and its impact socio -religious movement, British Economic Policies and their impact.	CO1
UNIT-3	Module -III Rise of Organized Movements: Emergence of Indian National Congress, its policies and programmes, partition of Bengal, rise of radical nationalists, Bal-Lal-Pal, formation of Muslim league; Minto-Morely reforms, the national movement during the first world war.	CO2
UNIT-4	Module -IV Gathering Momentum: Non-cooperation and civil disobedience, emergence of Gandhi, some prominent revolutionaries - Khudiram Bose, Prafulla Chaki, Bhupendra Nath Dutt,V.D. Savarkar, Sardar Ajitsingh, Lala Hardayal, Sardar Bhagat Singh, Raj Garu, Sukh Deo, Chandra Shekhar Azad, development of socialist ideas, communal divide.	CO3
UNIT-5	Module -V Towards Independence: Constitutional developments, provincial elections, quit India movement and after, participation of women national movement during the second world war, Indian national army, naval mutiny of 1946, freedom and partition, impact on the world.	CO4

	Learning Resources
Text Books	1. K. Majumdar, Advent of Indepedence, Bhartiya Vidya Bhavan, Bombay 1969. 2. R. Desai, Social Background of Indian Nationalism, 5th ed., Popular Prakashan, Mumbai, 1976. 3. Bandyopadhyay , Sekhar, Nationalist Movement in India. A reader, Oxford university press, 2008. 4. Chandra, Bipin, National and colonialism in modern India, Orient Longman Limited NewDelhi,1979.

19HS5501C – ENGINEERING FOR COMMUNITY SERVICE

Course Category:	Open Elective -1		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** the intricacies of engineering profession.	K2
CO2	**Examine** the role that engineering might play in the different aspects of sustainability development.	K3
CO3	**Solve** basic analytical and design problems using engineering tools, and be proficient and efficient in the use of these tools.	K3
CO4	**Explore** various awareness methods about safety, risk & risk benefit analysis.	K4
CO5	**Analyze** what constitutes social justice in different areas of social life and the role that engineering might play in these.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3	3				2	2	
CO2						3	3	3				2	2	
CO3						3	3	3				2	2	
CO4						3	3	3				2	2	
CO5						3	3	3				2	2	
Avg.						**3**	**3**	**3**				2	2	

1- Low	2-Medium	3-High

Course Content

UNIT-1	**The Engineering Profession** 1.1 On being a Professional 1.2 Technical Expertise and Ethical Obligations 1.3 Organization of Professional Engineering Engineering Codes of Ethics	CO1, CO2, CO5
UNIT-2	**Engineering and Sustainable Community Development** 2.1 Understanding Community 2.2 Engineers' Beliefs about Community Development 2.3 Measuring Sustainability Engineers as Problem Solvers	CO1, CO2, CO4
UNIT-3	**Engineers and Development** 3.1 Engineering Disasters: Lessons to be Learned 3.2 Technology for Community Development 3.3 Renewable Sources of Energy 3.4 Green and Smart Cities	CO1, CO3, CO4
UNIT-4	**Safety of the Public** 4.1 Ethical Dilemmas 4.2 Calculating the Value of Life 4.3 Whistle blowing 4.4 Trusting the Experts 4.5 Case Studies:	CO1, CO3, CO4

		a. Sinking of the Titanic	
		b. Bhopal Gas Tragedy	
UNIT-5	**Engineering and Social Justice**		CO1, CO3, CO5
	1.1	Social Justice in Engineering Sciences	
	1.2	Humanities and Social Sciences in Engineering Education	
	1.3	Transforming Engineering Education and Practice	
	1.4	Making Social Justice Visible and Valued	

Learning Resources

Reference Books	1. Deborah G. Johnson. (2020) *Engineering Ethics: Contemporary and Enduring Debates*. Yale University Press.
	2. Vesilind, P. Aarne., Gunn, Alastair S. (2010) *Hold Paramount: The Engineer's Responsibility to Society*. Cengage Learning.
	3. Luegenbiehl, Heinz., Clancy, Rockwell. (2017) *Global Engineering Ethics*. Butterworth-Heinemann, UK.
	4. Traer, Robert. (2018) *Doing Environmental Ethics*. New York: Routledge.
	5. Leydens, Jon., Lucena, Juan. (2017) *Engineering Justice: Transforming Engineering Education and Practice.* Wiley: IEEE Press.

19HS5501D – PERSONALITY DEVELOPMENT

Course Category:	Open Elective -1		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** the fundamentals of various aspects of personality traits.	K2
CO2	**Apply** various aspects of soft skills and personality development.	K3
CO3	**Analyse** the various techniques of stress management.	K4
CO4	**Acquire** the significant factors of affecting attitudes.	K3
CO5	**Develop** Interpersonal communication.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3				
CO2									3	3		3		
CO3									3	3		3		
CO4									3	3		3		
CO5									3	3		3		
Avg.									**3**	3		3		

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	Personality: Grooming one's personality, Personality traits, Influence of heredity and environment on personality, Effective habits Emotional intelligence.	CO1 CO4
UNIT-2	Conflict resolution Assertive nature Decision making skills.	CO1 CO2 CO5
UNIT-3	Techniques of time management Teamwork Self confidence Stress management	CO1 CO5
UNIT-4	Attitude-concept Positive attitude-advantages Negative attitude -disadvantages	CO1 CO3
UNIT-5	Qualities of successful leader Interpersonal relationship Good manners & etiquette.	

Learning Resources

Text Books	Personality development &soft skills BarunK.Mith Oxford.
Reference Books	https://www.usingenglish.com/comprehension/; https://www.englishclub.com/reading/short-stories.htm; https://www.english-online.at/ All Skills: https://www.englishclub.com/; http://www.world-english.org/ http://learnenglish.britishcouncil.org

19HS5501E – INTRODUCTION TO INTERNATIONAL BUSINESS

Course Category:	Open Elective -1			Credits:		3
Course Type:	Theory			Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil			Continuous Evaluation:		30
				Semester End Evaluation:		70
				Total Marks:		100

Course Outcomes

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

CO1	**Apply** the concepts of global dynamics which affect businesses and multinational firms in leveraging their capabilities and competencies.	K3
CO2	**Compare** and contrast cultures and societies globally using socioeconomic, cultural and ethical frameworks	K3
CO3	**Relate** business expansion concepts abroad to key issues related to their operations in other countries.	K3
CO4	**Develop** entry strategies into other markets by recognizing the nature of institutions and forces governing the process of globalization.	K6
CO5	**Use** the concepts in international business with respect to foreign trade.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			3	2							3	3		
CO2			3	2							3	3		
CO3			3	2							3	3		
CO4			3	2							3	3		
CO5			3	2							3	3		
Avg.			**3**	**2**							3	3		

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION:** History and Features of International Business. Globalization – Forces and dangers Firms' face during International Business. International Business Environment - Geographical, Economic, Socio-cultural, political and legal environment Culture and International Business	CO1 CO4
UNIT-2	Conceptual framework of Multinational Enterprise (MNE) International Trade and Foreign Direct Investment Understanding Emerging Markets and Regional Economic Integration Fundamentals of International Monetary System	CO1 CO2 CO5
UNIT-3	International economic institutions and agreements WTO, UNCAD, IMF, World Bank; Generalized system of preferences- GSTP International commodity agreements	CO1 CO5
UNIT-4	Modes of Operations in International Business Exporting, Importing, and Global Sourcing Differences between Domestic and International Business E-Business	CO1 CO3
UNIT-5	Social Responsibility and Ethics in International Business Counter trade IT and International Business Foreign Trade Policy/Trade Policy framework in India	

	Export Promotion: Export Facilities & Incentives and Status holders and Export Zones.	

Learning Resources

Text Books	1. Aswathappa," International Business", Tata Mc Graw Hill publications, New Delhi 2. Black and Sundaram, "International Business Environment", Prentice Hall of India, New Delhi. 3. Cherunilam Francis, "International Business", PHI Learning Pvt. Ltd., 2020
Reference Books	1. Adhikary, Manab, "Global Business Management", Macmillan, New Delhi. 2. Sumati Varma, "International Business", Pearson

Course Category:	Open Elective -1		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** the socio-economic-cultural conditions of ancient India	K2
CO2	**Know** the contribution of various dynasties to Indian Culture	K2
CO3	**Examine** the invasion of different foreign rulers and their effect on Indian culture	K3
CO4	**Analyse** the impact of British colonial rule on industrialisation and introduction of western education in India	K4
CO5	**Describe** the national movements against British rule.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2						2		1
CO2						2						2		1
CO3						2						2		1
CO4						2						2		1
CO5						1						1		1
Avg.						**2**						2		1

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Ancient Indian History and Culture** –Indus Valley Civilization: Salient Features, Vedic and Later Vedic culture, Doctrines of Jainism and Buddhism, Mauryans – Administration, Ashoka 's Dhamma, Satavahanas , Guptas –Socio-Economic-Cultural Conditions.	CO1
UNIT-2	**Medieval Indian History and Culture** – Delhi Sultanate, Great Mughals South Supremacy and Conflicts Pallavas , Cholas, Kakatiyas, Vijayanagara Empires their Contribution to Indian Culture.	CO2
UNIT-3	**Modern Indian History and Culture** – European penetration In to India, Anglo-French Rivalry for Supremacy, The battle of Plassey establishment of British Power, Consolidation and expansion tools, Subsidiary Alliance, Doctrine of Lapse.	CO3
UNIT-4	**Impact of British Colonial Rule** –Commercialization of Agriculture, de industrialization- decline of cottage Industries, famines and condition of Peasants, Introduction of Western Education in India, the great Revolt of 1857.	CO4
UNIT-5	**The Rise of Indian National Movement** – Socio- Religious Movements the Genesis of Freedom Movement –Birth of Indian National Congress, -Freedom Struggle (1885-1920) Moderate Phase Partition of Bengal-Emergence of Militant Nationalism-Swadeshi & Boycott Movement –Home Rule Movement Freedom Struggle (1920-1947) Gandhi's role in Indian National Movement.	CO4

Learning Resources

Text Books	Krishna Reddy, Indian History, McGraw Hill Education; Second edition, 2017
e- Resources &other digital material	https://onlinecourses.swayam2.ac.in/cec20_hs04/preview

19ES5601A – ENVIRONMENTAL MANAGEMENT

Course Category:	Open Elective - II		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19BS1103- Chemistry of Materials		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Analyze** the sources and composition of Municipal Solid Waste	K4
CO2	**Assess** the importance of the green technologies towards sustainability.	K5
CO3	**Determine** different types of Hazardous wastes and their safe disposal methods	K3
CO4	**Illustrate** importance of EIA and its assessment methodologies	K2
CO5	**Assess** impacts of air and water and their significance	K5

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION:** Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization, segregation of solid wastes – source reduction of waste – objectives of waste processing, elements of solid waste management – municipal and bio medical solid waste rules – public role in solid waste management.		CO1
UNIT-2	**INTRODUCTION TO GREEN TECHNOLOGY** Use of technology towards sustainability. IGBC rating systems, Understanding of green building measures in the areas of Site Preservation, Energy Efficiency, Materials, Water Conservation, Solar Energy- Wind energy- Basic Concepts-Sources and uses .		CO2
UNIT-3	**HAZARDOUS WASTE MANAGEMENT:** Sources and types of hazardous waste characteristics of hazardous wastes; collection-handling-processing techniques-disposal methods; hospital waste management - processing techniques - disposal.		CO3
UNIT-4	**CONCEPTUAL FACTS OF EIA:** Introduction, definition and scope of EIA objectives in EIA, basic EIA principles, classification of EIA, strategic EIA (SEIA), regional EIA, sectoral EIA, project level EIA and life cycle assessment, project cycle, Environmental baseline monitoring (EBM), preliminary study to determine impact significance, Impact Assessment Methodologies.		CO4
UNIT-5	**PREDICTION OF IMPACTS (AIR AND WATER):** Air and water environment, sources and basic information on water and air conceptual approach for addressing air and water environment impacts, assessment of impacts air, water, noise, soil, biological and socioeconomic impacts, assessment of impact significance.		CO4

Learning Resources

Text Books	1. Integrated Solid waste management by GoergeTchobanolous, Hilary Theisen & Samuel A. Vigil. McGraw Hill International Editions 2. Y. Anjaneyulu, Environmental Impact Assessment, B.S. Publications, 2003.
Reference Books	1. CPCB Manual on solid waste Management 2. Technological guidance manuals of EIA, MoEF 3. M. Anjireddy, Textbook of Environmental Science and Technology, BS Publications, 2010.
e- Resources & other digital material	1. www.nptel.ac.in/courses/120108005 2. nptel.ac.in/courses/10510605 3. https://www.coursera.org/learn/solid-waste-management

19ES5601B – TELECOMMUNICATION FOR SOCIETY

Course Category:	Open Elective - II		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Infer** the basic knowledge of telecommunication system, regulation and standards of telecom regulatory bodies.	K2
CO2	Able to **deduce** cost of different devices such as mobile, Wi-Fi and DTH operators and carry out investigation of Frequency Management and Business on Bandwidth.	K3
CO3	Make **use** of revolutionary changes in mobile and wireless technologies to understand recent developments.	K3
CO4	**Examine** different optical communication components.	K3
CO5	**Justify** the use of satellite orbits, different components and sub-systems in advanced communication systems.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**TELECOMMUNICATION SYSTEMS:** Telephones, Telephone System, Facsimile, Internet Telephony. Telecommunication Standards and Regulations - International telecommunication union (ITU) - TRAI and its role – Frequency management – Cost computations – Mobile and DTH operations – Role of wireless planning commission (WPC) for telecommunications in India.	CO1
UNIT-2	**TELECOM BUSINESS MANAGEMENT:** Automated teller machines – Teleconferencing – Telecommuting –Customer oriented communication aspects – Telecom billing - Concepts of data rate and bandwidth requirements – Digital subscriber line – Broadband technologies – Digital home – Voice enabled DSL.	CO2
UNIT-3	**CELL PHONE TECHNOLOGIES**: Cellular Telephone Systems, A Cellular Industry Overview, 2G and 3G Digital Cell Phone Systems, Long Term Evolution and 4G Cellular Systems **WIRELESS TECHNOLOGIES:** Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless Networks, WiMAX and Wireless Metropolitan-Area Networks	CO3
UNIT-4	**OPTICAL COMMUNICATION:** Optical Principles, Optical Communication Systems, Fiber-Optic Cables, Optical Transmitters and Receivers.	CO4
UNIT-5	**SATELLITE COMMUNICATION:** Satellite Orbits, Satellite Communication Systems, Satellite Subsystems, Ground	

	Stations, Satellite Applications, Global Navigation Satellite Systems.	CO4
	Learning Resources	
Text Books	1. Louis E. Frenzel Jr., Principles of Electronic Communication Systems, 4/e, Mc Graw Hill Publications, McGraw-Hill Education, 2016.	
	2. Willium C. Y. Lee, "Wireless & Cellular Telecommunications", McGraw-Hill Companies Inc, Third Edition, 2006.	
Reference Books	1. Wayne Tomasi, Electronic Communication Systems, 5/e, Pearson Education, 2009. 2. Wayne Tomasi, Advanced Electronic Communication Systems, 4/e, Pearson Education, 2013. 3. Dennis Roddy, Electronic Communications, 4/e, Pearson Education, 2003.	

19HS5601A – GERMAN FOR BEGINNERS

Course Category:	Open Elective -II		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Learn** basics of German Language and develop a consciousness for the cultural background of the language.	K5
CO2	**Understand** authentic texts/ announcements in German	K2
CO3	**Express** themselves according to the situations and to give/seek information in German	K2
CO4	**Read** and respond to an extract from a story, an e-mail message or song or simple text	K1
CO5	**Write** the spellings correctly and sentences in a grammatically correct form	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										1				
CO2										1				
CO3										1				
CO4										1				
CO5										1				
Avg.										1				

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION:** Alphabets, Numbers, Basic Vocabulary, German States & Its Culture	CO1
UNIT-2	Modal Verbs, Separable and Inseparable Verbs, Transitive and Intransitive Verbs, Verb Conjugation,	CO2
UNIT-3	Adverbs, Prepositions, Personal Pronouns, Adjectives	CO3
UNIT-4	Present Tense, Past Tense, Future Tense	CO4
UNIT-5	The Nominative Case, Accusative Case, Dative Case, Genitive Case, The Imperative	CO4

Learning Resources

Text Books	Netzwerk A1 Deutsch alsFremdsprache by Goyal Publications, New Delhi
e- Resources & other digital material	1 E-Resources and other digital material.

19ES5601C – ANALYTICAL ESSAY WRITING

Course Category:	Open Elective-II		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** the meaning of analysis and how to analyze the content of essays, paragraphs, reviews, books, articles etc.	K2
CO2	**Classify** various types of analytical topics according to context and make reports. Organize the topic and prepare hypothesis.	K3
CO3	**Construct** meaningful arguments by following thematic information and suitable language.	K3
CO4	**Analyze** thesis statement, topic sentences, evidence, and supporting ideas.	K4
CO5	**Distinguish** the general essays from analytical essays and reorganize the content.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	Identifying the topic sentences – meaning of analysis – History of essay writing – Different types of essays – Role of analytical essays	CO1
UNIT-2	Fundamental prose skills – explore the content – discover various approaches in writing essays – Hypothesis of the topic or research	CO2
UNIT-3	Discussing and emulating different topics – traditional methods of essay writing – sophisticated way to present the topics	CO3
UNIT-4	Analyze the essays – anthology of essays – Using analytical essays in different contexts – Competitive exams orientation – Comprehensive questions	CO4
UNIT-5	Types of essays – differentiation of essays – contemporary essayists like Hazlitt, David Foster Wallace, Montaigne, Jawaharlal Nehru, Jiddu Krishna Murthy, Iris Murdoch, Woolf Bacon, RW Emerson, Samuel Johnson, George Orwell, James Baldwin, Agatha Christie, Jane Austen etc.	CO4

Learning Resources

Reference Books	1. Ariel Levy, ed., The Best American Essays 2015, Houghton Mifflin, 2015 2. Philip Lopate, ed., The Art of the Personal Essay (Anchor Books 1997) 3. David Foster Wallace, Consider the Lobster and Other Essays, Back Bay Books, 2007 4. Revising Prose by Richard Lanham 5. 100 ways to improve your writing by Gary Provost

	6. Bird by Bird by Anne Lamott
	7. The Sense of Style by Steven Pinker
e- Resources & other digital material	https://canvas.harvard.edu/courses/8124
	https://boomessays.com/blog/how-write-analytical-essay#definition
	https://www.ranker.com/list/best-essayists/ranker-books

19ES5601D– INDIAN ECONOMY

Course Category:	Open Elective-II		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understanding** of the fundamental concepts of Indian economy and theoretical background.	K2
CO2	**Apply** knowledge to evaluate the impact of the population, unemployment and poverty on the economic development.	K3
CO3	**Understanding** of the role of public and private sector in the Indian economy.	K2
CO4	A**wareness** on structure and growth of capital market in India industrial growth, how to align the management of a supply chain with corporate goals and strategies.	K5
CO5	**Analysing** Public expenditure trends, issues and Assessment of Indian planning.	K4

	Contribution of Course Outcomes towards achievement of Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2								3	3	
CO2	3	3		2								3	3	
CO3	3	3		2								3	3	
CO4	3	3		2								3	3	
CO5	3	3		2								3	3	
Avg.	**3**	**3**		**2**								3	3	

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**ECONOMIC DEVELOPMENT:** A theoretical back ground: Economic growth, development and under development characteristics of under developed and developing countries. Nature of the Indian economy, role of natural resources in economic development. Environmental protection and sustainable development.	CO1
UNIT-2	**POPULATION AND HUMANDEVELOPMENT:** Indian population size and growth trends, reasons of the rapid growth of population, population and economic development. Employment and unemployment in India, the concept of poverty and rural poverty, income distribution in India.	CO2
UNIT-3	**INDUSTRIAL SECTOR AND SERVICES IN INDIAN ECONOMY:** Various industrial policies, role of public and private sector in the Indian economy policy 1991, Industrial sickness in India. foreign trade and foreign capital. Balance of payments, TO and India.	CO3
UNIT-4	**MONEY AND BANKING:** Characteristics of the Indian money market, price trends and inflation, commercial banking in India. Capital market in India, structure and growth of capital market in India industrial growth, RBI, Evolutional of institutional financing in India.	CO4
UNIT-5	**PUBLIC FINANCE, ECONOMIC PLANNING AND POLICY:** FISCAL policy and monetary policy, Indian tax structure. Public expenditure trends and issues. **ECONOMIC PLANNING AND POLICY:** Evaluation of the objectives of economic planning, important features of Indian plans, Assessment of Indian	CO4

	planning.	

Learning Resources

Text Books	1. Misra and Puri Indian economy Himalaya Publishing House twenty eight revised and updated edition 2010. 2.T. Dyson, 2008, ―India's Demographic Transition and its Consequences for Development in Uma Kapila, editor, Indian Economy Since Independence, 19th edition, Academic Foundation. 3. Dr. S.K. Singh/Prof. T.N. Jha/Dr.vinita Singh Economic Development 21st Century Edition. **4.** .A. Musgrave and P.B. Musgrave, Public Finance in Theory &Practice,Mc Graw Hill Publications, 5th edition, 1989.

19ES5601E – PUBLIC ADMINISTRATION

Course Category:	Open Elective-II						Credits:		3		
Course Type:	Theory						Lecture-Tutorial-Practical:		3-0-0		
Prerequisites:	Nil						Continuous Evaluation:		30		
							Semester End Evaluation:		70		
							Total Marks:		100		

Course Outcomes

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

CO1	**Describe** the scope and significance of public administration	L2
CO2	**Explain** different administrative thoughts.	L2
CO3	**Illustrate** accountability and control over administration by different groups in society	L2
CO4	**Explain** the concepts of union and state government administration	L2
CO5	**Summarize** the administration process in civil services	L2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**INTRODUCTION;** Meaning, scope and significance of public administration, evolution of the discipline and its present status, challenges of liberalization, privatization and globalization, good governance, electronic governance concepts and applications, New Public Management (NPM)	CO1
UNIT-2	**ADMINISTRATIVE THOUGHT:** Scientific management theory, classical theory, bureaucratic theory, human relations theory, system theory.	CO2
UNIT-3	**ACCOUNTABILITY AND CONTROL:** Legislative, executive and judicial control over administration, role of media, interest groups, NGOs, civil society, Right to Information Act (RTI), social audit, citizen chapters.	CO3
UNIT-4	**UNION AND STATE GOVERNMENTS ADMINISTRATION:** President, Prime minister, council of ministers, cabinet, central and state secretariats, boards and commissions, governor, chief minister and council of ministers, central state relations, finance commission, Neetiayog.	CO4
UNIT-5	**CIVIL SERVICES:** Recruitment, training and other condition of services, district administration, role of collector, local self-governing institutes – 73rd and 74th constitutional amendments act.	CO4

Learning Resources

Text Books	1. Avasti, Maheswari, Public Administration, 31/e. Lakshmi Narian Agarwal Books, India, 2014 2. B.L. Fadia, Kuldeep Fadia, Indian Administration, 8/e, Sahitya Bhawan, India, 2014.

	1. Nicholas Henry, Public Administration and Public Affairs, 21/e. Prentice Hall of India, 2012.
Reference Books	2. D.Ravindra Prasad, V.Sivalinga, P.Satyanarayana, Administrative Thinkers, 2/e. Sterling Publishers, 1991.
	3. D.D.Basu, Introduction to the Indian Constitution, 21/e, Lexis Nexis Butterworths, Wadhwa, Nagpur, 2013.
	4. Ramesh K, Arora, Rajini Goyal, Indian Public Administration, 3/e, New Age International Publishers, India, 1995.

19HS5601F – NATIONAL SERVICE SCHEME

Course Category:	Open Elective –II		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the community in which they work and their relation.	K2
CO2	**Identify** the needs and problems of the community and involve them in problem-solving.	K3
CO3	**Develop** capacity to meet emergencies and natural disasters.	K3
CO4	**Take** part in national integration and social harmony.	K4
CO5	**Apply** their knowledge in finding practical solutions to individual and community problems.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**NATIONAL SERVICE SCHEME** A) History and its Objectives B) Organizational structure of N.S.S. at National, State, University and College Levels Advisory committee and their functions with special reference to college principal, Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation	CO1
UNIT-2	**National Integration** A) Need of National integration Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc.	CO2
UNIT-3	**N.S.S. REGULAR ACTIVITIES** A) Traffic regulation B) Working with Police Commissioner's Office C) Working with Municipal Corporation of Vijayawada D) Working with Health Department E) Blind assistance F) Garments collection G) Non-formal education H) 'Environmental Education, Awareness and Training (EEAT)' Blood donation	CO3
UNIT-4	**SPECIAL CAMPING PROGRAMME** A) Nature and its objectives	CO4

	B) Selection of camp site and physical arrangement	
	C) Organization of N.S.S. camp through various committees and discipline in the camp.	
	D) Activities to be undertaken during the N.S.S. camp.	
	Use of the mass media in the N.S.S. activities.	
UNIT-5	**SPECIAL PROGRAMME** A) Legal awareness B) Health awareness C) First-aid D) Career guidance E) Leadership training - cum - Cultural Program Globalization and its Economic Social Political and Cultural impacts.	CO5

Learning Resources

Text Books	1. National Service Scheme Manual, Government of India.
Reference Books	1. Training Programme on National Programme scheme, TISS. 2. Orientation Courses for N.S.S. Programme officers, TISS. 3. Case material as Training Aid for field workers, Gurmeet Hans. 4. Social service opportunities in Hospitals, Kapil K.Krishan,TISS. 5. Social Problems in India, Ram Ahuja.

19ES5601G – PROFESSIONAL COMMUNICATION

Course Category:	Open Elective – II		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Communicate** proficiently in interviews and all social situations.	K2
CO2	**Demonstrate** an ability to use effective verbal and non-verbal communication skills.	K3
CO3	**Use** the formats, strategies and possible content of business communication at work place.	K3
CO4	**Prepare** professional documents including web related (On-line) communication.	K3
CO5	**Analyze** texts, diagrams and improve both reading and writing skills which would help in academics as well as professional career.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2									3	3		3		
CO3									3	3		3		
CO4									3	3		3		
CO5									3	3		3		
Avg.									**3**	3		3		

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**VERBAL COMMUNICATION** Conciseness, clarity, correctness, Non-verbal communication – body language, Barriers to communication, Reading Short Passages, News Articles, Technical Papers and Short Stories - Note making and note taking.	CO1
UNIT-2	**PROFESSIONAL LETTERS** Purpose, Style and format, E- mail – format and etiquette., Presentation skills, Group discussion.	CO2
UNIT-3	**TECHNICAL REPORT WRITING –** Types: Business/Technical, Components, Style and Formats – Writing a Technical Proposal, Administrative drafting and correspondence - Memos, Minutes and Web notes.	CO3
UNIT-4	Information transfer, Meeting skills, Team dynamics	CO4
UNIT-5	**JOB APPLICATION** Resume – Structure of Resume/CV – covering letter – writing SOPs. Interview Skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online interviews, one-to-one interview & panel interview, FAQs related to job interviews, answering strategies.	CO5

Learning Resources

Text Books	1. Basu B.N. Technical Writing, 2011 Kindle edition 2. C Muralikrishna& Sunitha Mishra, Communication Skills for Engineers, 2 nd edition, NY: Pearson, 2011.

	3. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014. 4. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
Reference Books	1. https://www.britishcouncil.org/english 2 http://www.5minuteenglish.com/ 3. http://www.bbc.co.uk/learningenglish/ 4. http://www.better-english.com/ 5. http://www.nonstopenglish.com/ 6. https://www.usingenglish.com/comprehension/ 7. https://www.englishclub.com/reading/short-stories.htm 8. https://www.english-online.at/ 9. https://www.englishclub.com/ 10. http://www.world-english.org/http://learnenglish.britishcouncil.org/

19ES5601H – BASICS OF FINANCE

Course Category:	Open elective-II		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understanding** of the basics of finance and objective of finical management	K2
CO2	**Acquire** knowledge in financial planning and implementation of financial plans	K2
CO3	**Understanding** problems of over-capitalisation and under-capitalisation	K2
CO4	**Know** about time value of money and financial forecast	K2
CO5	**Capability** to **analyse** various sources of loans and identify the best source of loan for finance.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2								3	3	
CO2	3	3		2								3	3	
CO3	3	3		2								3	3	
CO4	3	3		2								3	3	
CO5	3	3		2								3	3	
Avg.	**3**	**3**		**2**								3	3	

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**INTRODUCTION:** Business Finance Defined-Traditional and Modern Views; Scope and Functions of Finance; Finance Function vs. Accounting Function; Objectives of Financial Management-Profit Maximization vs. Wealth Maximization.	CO1
UNIT-2	**FINANCIAL PLANNING:** Concept of Financial Planning; Process of Financial Planning; Characteristics of Sound Financial Plans; Factors Affecting Financial Plan.	CO2
UNIT-3	**CAPITALISATION AND CAPITAL STRUCTURE**: Concept, Nature and Scope of Capitalisation; Earnings Theory and Cost Theory of Capitalisation; Over-Capitalisation; Under-Capitalisation; Capital Structure Theories and Factors Determining Capital Structure	CO3
UNIT-4	**FINANCIAL FORECASTING AND TIME VALUE OF MONEY**: Concept of Financial Forecasting; Sales Forecast; Income Forecast; Financial Position Forecast; Forecasting for Growth and External Funds Requirements; Time Value of Money-Discounting and Compounding.	CO4
UNIT-5	**PATTERN OF CAPITAL REQUIREMENTS**: Long-Term and Medium-Term Financing – Purpose, Sources and Instruments; Short-Term Financing-Purpose, Sources and Instruments.	CO5

Learning Resources

Text Books	1. Brealey, Richard A and Steward C. Myers: Corporate Finance, McGraw Hill, Int.Ed., New York.
	2. Chandra, Prasanna : Financial management, Tata Mc Graw Hill, Delhi.
	3. Hampton, John: Financial Decision Making, Prentice Hall, Delhi.
	4. Pandey, I.M.: Financial Management, Vikas Publishing House, Delhi.

	Van Horne, J.C. and J.M. WachowiczJr. : Fundamentals of Financial Management, Prentice-Hall, Delhi.
Reference Books	1. Van Horne, James C Financial Management ; Harper and Row, New York. 2. Pinches, George E : Essentials of Financial Management ; Harper and Row, New York. 3. Khan MY, Jain PK : Financial Management ; Tata McGraw Hill, New Delhi. 4. Archer, Stephen, H., Chate G Marc, Racette, George; Financial management ; John Wiley, New York. Block, Stanley B, Geoffrey A Hilt : Foundations of Financial Management ; Richard D. Irwin, Homewood.

19ES5601I – BASICS OF MARKETING

Course Category:	Open elective-II		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** issues of marketing with an emphasis on learning to develop responsive marketing strategies that meet customer needs	K2
CO2	**Using** of the key analytical frameworks and tools used in marketing in relation to segmenting and targeting of products	K2
CO3	**Get acquainted** with the components of marketing mix, stages in new product development	K2
CO4	**Analyse** the objectives and methods for pricing products and selecting channel members	K4
CO5	**Evaluate** the techniques of promotion mix	K5

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							3	3	2			3		3
CO2							3	3	2			3		3
CO3							3	3	2			3		3
CO4							3	3	2			3		3
CO5							3	3	2			3		3
Avg.							**3**	**3**	**2**			3		3

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**INTRODUCTION TO MARKETING:** Definition, Nature, Scope, Importance of Marketing, Core Concepts of Marketing, Philosophies of Marketing.	CO1
UNIT-2	**MARKET SEGMENTATION** Targeting and Positioning: Definition, Levels of Segmentation, Bases of Segmentation, Target Market, Positioning Strategies.	CO2
UNIT-3	**MARKETING MIX:** 4P's, Classification of Products, Product Life Cycle (PLC)-Stages, New Product Development (NPD)- Types, Process	CO3
UNIT-4	**PRICING:** Definition, Objectives, Pricing Strategies- Channels of Distribution: Definition, Functions, Levels	CO4
UNIT-5	**PROMOTION MIX:** Definition, Objectives, Importance, Elements, Integrated Marketing Communication (IMC).	CO5

Learning Resources

Text Books	1. Philip Kotler, Gary Armstrong and Prafulla Agnihotri, Principles of Marketing, Pearson India, 17th Edition. New Delhi: 2018 Rajan Saxena, Marketing Management, Tata-McGraw Hill, Fifth Edition New Delhi :2015
Reference	5. Etzel, Walker, Stanton &Pandit, "Marketing Concepts & Cases", Tata

Books	McGraw Hill, New Delhi.
	6. Govindarajan M., "Marketing Management, Concepts, Cases, Challenges and Trends", PHI Private Limited, New Delhi, 2007.
	7. Karunakaran, "Marketing Management", Himalaya Publishing House, Mumbai.
	Charles W. Lamb, Joseph F. Hair, Carl McDaniel, Harish Kapoor, Henry Klaise "MKTG", Cengage Learning, New Delhi, 2012.
e- Resources & other digital material	8. https://nptel.ac.in/courses/110/104/110104068/
	9. https://nptel.ac.in/courses/110/107/110107147/
	10. https://nptel.ac.in/courses/110/104/110104070/

INTERDISCIPLINARY ELECTIVES SYLLABUS

19CS2501A – DATA BASE MANAGEMENT SYSTEMS

Course Category:	Inter disciplinary Elective -1		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the basic concepts of database management systems	K2
CO2	**Understand** normalization techniques with simple examples.	K2
CO3	**Apply** SQL commands to create tables for a given database application	K3
CO4	**Apply** ER Model concepts to draw ER Diagrams for a given database application and make an effective report.	K3
CO5	**Understand** the basic concepts of database management systems	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3													
CO3	3													
CO4	3													
CO5	3								3	3				
Avg.	**3**								**3**	3				

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**INTRODUCTION TO DATABASES:** Characteristics of the Database Approach, Advantages of using theDBMS Approach, A Brief History of Database Applications. **OVERVIEW OF DATABASE LANGUAGES AND ARCHITECTURES:** Data Models, Schemas and Instances,Three-Schema Architecture and Data Independence, Database Languages and Interfaces, Database System environment, Centralized and Client-Server Architecture for DBMS.	CO1
UNIT-2	**RELATIONAL MODEL:** The Relational Model Concepts, Relational Model Constraints andRelational Database Schemas. **SQL:** Data Definition, Constraints, Basic Queries and Updates, Views(Virtual Tables) inSQL	CO2
UNIT-3	**CONCEPTUAL DATA MODELING:** High-Level Conceptual Data Models for Database Design, ASample Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types. **ER-DIAGRAMS:** Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues	CO3
UNIT-4	**DATABASE DESIGN THEORY**: Functional Dependencies, Normal forms based on Primary Keys,Second and Third Normal Forms, Boyce-Codd Normal Form.	CO4
UNIT-5	**TRANSACTION PROCESSING**: Introduction, Transaction and System Concepts, Desirable Properties ofTransactions. **Introduction to Protocols for Concurrency Control in Databases:** Two-Phase LockingTechniques for Concurrency Control - Types of Locks and System Lock	CO5

	Tables.	
Learning Resources		
Text Books	1. DATABASE SYSTEMS Models, Languages, Design and Application Programming, RamezElmasri, ShamkantB.Navathe, 6th Edition, Pearson.	
Reference Books	1. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, 3rd Edition, TMH. 2. Data base System Concepts, Abraham Silberschatz, Henry F Korth, S.Sudarshan, 5th Edition, Mc Graw Hill.	

Course Category:	Inter disciplinary Elective -1		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** the basic concepts for solutions to business problems.	K2
CO2	**Apply** the analytical techniques in business transactions that would help in making effective business decisions	K3
CO3	**Analyze** problems in business transactions that would help in making effective business.	K4
CO4	**Apply** the least square technique to find the equation of the curve.	K3
CO5	**Determine** the equation of the curve from the given data.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION TO STATISTICS:** Meaning, Definition, Functions, Importance, Limitations of Statistics, Collection of Primary and Secondary Data.	
UNIT-2	**MEASURES OF CENTRAL TENDENCY:** Definition, Objectives, Characteristics and Techniques: Mean Median, Mode, Geometric Mean and Harmonic Mean.	CO1, CO2, CO3
UNIT-3	**MEASURES OF DISPERSION**: Definition, objectives, Characteristics and Techniques: Range, Quartile Deviation, Mean Deviation, Standard Deviation and Coefficient of Variation.	
UNIT-4	**MEASURES OF SKEWNESS & KURTOSIS**: Definition, types of skewness, types of kurtosis, Karl-Pearson's Co-efficient, Bowley's Co-efficient, Kelly Co-efficient, Calculation of Raw Moments and Central Moments	
UNIT-5	**CURVE FITTING:** Method of least squares, straight line, parabola, exponential curve, power curve	CO1 CO4 CO5

Learning Resources

Text Books	1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
	2. Dr.T.K.V. Iyengar, Dr.B.Krishna Gandhi, S. Ranganatham, Dr. M.V.S.S.N. Prasad, "Probability & Statistics", Publications: S.Chand, 4th Revised Edition, 2012.
Reference	1. S. Ross, a First Course in Probability, Pearson Education India, 2002.

Books	3.	Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
E-Resources& other digital material	1.	www.nptelvideos.com/mathematics/(Math Lectures from Mit,Stanford,IIT'S
	2.	nptel.ac.in/courses/111/106/111106150/
	3.	nptel.ac.in/courses/111105035

19IT2501C – OOP WITH C++

Course Category:	Inter disciplinary Elective -1		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	19ES1102-Problem Solving and Programming		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Illustrate** the fundamental programming concepts in C++	K2
CO2	**Demonstrate** the concepts of Object-Oriented Programming.	K2
CO3	**Outline** the concepts of polymorphism and Exception handling in C++	K2
CO4	**Make** use of OOP concepts to develop C++ programs (L3)	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2					1	1				2	2
CO2	2	2	2					1	1				2	2
CO3	2	2	2					1	1				2	2
CO4	2	2	2					1	1				2	2
Avg.	**2**	**2**	**2**					**1**	**1**				2	2

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION TO C++:** Difference between C and C++, Evaluation of C++, Programming Paradigms, Key concepts of OOP, Advantages of OOP. **DECLARATIONS: TOKENS**, Variable declaration and initialization, Data types in C++, Operators in C++, Scope access operator, Name Space, Memory management operators, Comments. **DECISION STATEMENTS:** Introduction, The if statement, Multiple ifs, Nested if-else, else-if ladder, unconditional control transfer statements, the switch statement
UNIT-2	**CONTROL LOOP STRUCTURES:** Introduction, what is loop, The for loop, the while loop, The do-while loop **FUNCTIONS IN C++:** Introduction, Parts of a function, Passing arguments, Inline functions, Function overloading **INPUT AND OUTPUT IN C++:** Streams in C++ and Stream Classes, Pre-defined streams.
UNIT-3	**CLASSES AND OBJECTS**: Introduction, Structure in C, Classes in C++, declaring Objects, Access specifiers and their scope, Defining member functions, Characteristics of member functions, Outside member function as inline, Rules for inline functions, Static member variable, static member functions, friend functions. **CONSTRUCTORS AND DESTRUCTORS**: Introduction, Constructors and destructors, Constructors with default arguments, Parameterized constructor, Overloading constructors, Array of objects using constructors, Constructors with default arguments **OPERATOR OVERLOADING:** Introduction, the keyword operator, overloading unary operators, Overloading binary operator.

The UNIT-1 row (spanning into the right) is tagged with: CO1, CO2, CO3

UNIT-4	**INHERITANCE**: Introduction, Reusability, Access Specifies and Simple inheritance, Types of inheritance, Single, Multiple, Hierarchical, Hybrid, Multipath inheritances, Virtual base classes, program on simple inheritance **POINTERS**: Introduction, Features of pointers, Pointer Declaration, void pointer, wild pointer, this pointer, Pointers to derived class and base class	
UNIT-5	**BINDING AND POLYMORPHISM AND VIRTUAL FUNCTIONS**: Introduction, Binding in C++, Pointer to base class and derived class objects, Virtual functions, pure virtual functions, Abstract classes. **EXCEPTION HANDLING**: Introduction, Principles of exception handling, the keywords try, throw and catch, Multiple catch statements, Re-throwing an exception.	CO1 CO4 CO5

Learning Resources

Text Books	1. Programming in C++, Second Edition, by Ashok N Kamthane, Pearson Education
Reference Books	1. C++ How To Program, Dietel and Dietel, Prentice Hal . 2. C++ The Complete Reference, 5th Edition, by Herbert Schildt, TMH.
E-Resources& other digital material	4. http://www.cplusplus.com 5. https://www.w3schools.com/cpp/

19IME2501A– COMPUTATIONAL METHODS

Course Category:	Inter disciplinary Elective -1		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Solve** System of equations using direct and iterative methods	K3
CO2	**Solve** Boundary and characteristic Value Problems	K3
CO3	**Determine** approximatelinear and nonlinear curve using regression analysis	K3
CO4	**Find** a numerical solution to partial differential equations	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1												2	2	
CO2												2	2	
CO3												2	2	
CO4												2	2	
CO5												2	2	
Avg.												2	2	

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**Introduction to numerical methods applied to engineering problems:** Examples, solvingSets of equations– Matrix notation–Determinantsand inversion–Iterative methods–Relaxation methods–Systems of non-linear equations.	
UNIT-2	**Boundary value problems and characteristic value problems:** Shooting method– Solution through a set of equations –Derivative boundary conditions–Characteristic value problems.	CO1, CO2, CO3
UNIT-3	**Curve fitting and approximation of functions:** Least square approximation fitting of non- linear curves by least squares – regression analysis- multiple linear regression, non-linear regression.	
UNIT-4	**Numerical solutions of partial differential equations:** Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – Poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangulargrid.	
UNIT-5	**Parabolic partial differential equations:** Explicit method– Crank-Nicolson method– Derivative boundary condition–Stability and convergence criteria. **Hyperbolic partial differential equations:** Solving wave equation by finite differences- stability of numericalmethod–method of characteristics-wave equation in two space dimensions.	CO1 CO4 CO5

Learning Resources

Text Books	1. StevenC.Chapra,RaymondP.Canale"NumericalMethodsforEngineers"Tata Mc- Grawhill,,Fifth edition.
	2. 2. Curtis F.Gerald, partick.O.Wheatley,"Appliednumerical analysis" Pearson Education –Sixth Edition.2002
Reference Books	1. . Ward cheney&David Kincaid "Numerical mathematicsandcomputing"Brooks/colepublishingcompany1999,fourthedition.

	2. RileyK.F.M.P.Hobson&BenceS.J," mathematical methods for physics and engineering" Cambridgeuniversitypress,1999.
E-Resources& other digital material	1. https://www.nptel.ac.in/courses/111/107/111107105/ 2. https://www.nptel.ac.in/courses/111/105/111105041/ 3. https://www.nptel.ac.in/courses/111/106/111106112/ 4. https://www.nptel.ac.in/courses/111/105/111105090/

19EE2701A– RENEWABLE ENERGY RESOURCES

Course Category:	Inter disciplinary Elective -1I		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understand** the basics of solar energy, wind energy, bio mass, geothermal energy, Ocean energy and principles of energy conversion	K2
CO2	**Explain** and classify instruments for measuring solar radiation solar collectors, solar energy storages, wind turbines, geothermal, MHD and fuel cell.	K4
CO3	**Explai**n and classify instruments for measuring solar radiation solar collectors, solar energy storages, wind turbines, geothermal, MHD and fuel cell.	K4
CO4	**Outline** about solar radiation, power from solar module, performance characteristics of wind mill, potential and conversion techniques of tidal and wave energy, mini-hydel power plants and their economics.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	2-Medium	3-High

Course Content

UNIT-1	Principles of Solar Radiation and Solar Energy Collection Role and potential of new and renewable source, the solar energy option, environmental impact of solar power, physics of the sun, the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data. Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors	CO1, CO2, CO3 CO4
UNIT-2	Solar Energy Storage, Applications and Photovoltaic Energy Conversion Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications solar heating/cooling technique, solar distillation and drying. Solar cell fundamentals, solar cell classification, performance of solar cell- power from solar module	CO1, CO2, CO3 CO4
UNIT-3	Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria. Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking	
UNIT-4	Geothermal Energy and Ocean Energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.	
UNIT-5	Geothermal Energy and Ocean Energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, principles of utilization, setting of	CO1 CO4

OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.	CO5

Learning Resources

Text Books	1. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th edition,2014. 2. 2. Renewable Energy Sources and Emerging Technologies by D.P Kothari, K.C Singal, Rakesh Ranjan , PHI learning Pvt Ltd, 2nd edition ,2012
Reference Books	1. Renewable Energy resources byTiwari and Ghosal, publisher Narosa,2005 2. Renewable Energy Resources by John Twidell and Tony Weit, publisher Taylor and Francis, 2ndeditin 2006. 3. Solar Photo Voltaics Fundamentals, Technology and application by Chetan Singh Solanki, publisher PHI learning Pvt Ltd, 3rd edition, 2019 4. Wind Energy Theory and Practice by Siraj Ahmed publisher PHI learning Pvt Ltd, 3rd edition 2016.

Course Category:	Inter disciplinary Elective -1I		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Understand** the basic concepts of HTML, CSS, XML, JDBC connectivity, Servlets and JSP	K2
CO2	**Use** Java script for validation of web pages.	K3
CO3	**Analyze** the concepts of DOM, JDBC Architecture and life cycles of Servlets and JSP.	K4
CO4	**Compare** the concepts of HTML and XML, Servlets and JSP.	K4
CO5	**Develop** simple web applications using JDBC, servelet and JSP.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			2		2								2	2
CO2			2		2								2	2
CO3			2		2									
CO4			2		2									
CO5			2	2	2									
Avg.			**2**	**2**	**2**								2	2

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**INTRODUCTION TO WEB TECHNOLOGIES:** History of the web, Overview of HTTP, HTML Introducing HTML document structure, Creating Headings, links, paragraph, images, tables, frames, forms and html controls on a web page	CO1
UNIT-2	**INTRODUCING CASCADING STYLE SHEETS:** Inline, External, Internal, Style class, Multiple styles, Introducing JavaScript, Using Variables, Using Operators, Working with Control Flow statements, working with functions, Handling Events, Using Arrays, Creating objects in Java Script	CO2
UNIT-3	**WORKING WITH XML:** Introduction to XML, XML Basics, XML Technologies, Extensible HTML (XHTML), Java API for XML Processing, Document Object Model (DOM)	CO1 CO3
UNIT-4	**WORKING WITH DATABASE:** Getting started with JDBC, Defining ODBC, Introduction to JDBC, Components of JDBC, JDBC Architecture, Types of Drivers, Working with JDBC APIs, creating a Simple Application, Working with Prepared Statement, Using Callable Statement	CO1 CO3 CO4 CO5
UNIT-5	**WORKING WITH SERVLETS:** Introducing the MVC architecture, Describing Servlets, Understanding Servlets, what are servlets, introducing the Servlet API, Servlet Life Cycle, Developing First Servlet Application **WORKING WITH JSP:** Introduction to JSP, Understanding JSP, Describing the JSP Life Cycle, Creating a Simple JSP pages	CO1 CO4 CO5

Learning Resources

Text Books	1. Web Technologies, Black Book, Kogent Learning Solutions Inc, Dreamtech Press. 2. JDBC, Servlets, and JSP, New Edition, Santhosh Kumar K, Kogent Learning Solutions Inc, Dreamtech Press.
Reference Books	1. Web Technologies ,Uttam K. Roy, Volume 2 , Oxford University 2. Core Servlets and Java Server Pages Volume 1 CORE TECHNOLOGIES , Marty Hall and Larry Brown Pearson 3. Internet and World Wide Web – How to program ,Dietel and Nieto 4. An Introduction to Web Design and Programming –Wang-Thomson 5. Professional Java Server Programming S.AllamRaju and othersApres(dreamtech) 6. Java Server Programming ,IvanBayross and others,The X Team,SPD 7. Beginning Web Programming-Jon Duckett WROX. 8. Java Server Pages, Pekowsky, Pearson.
E-Resources& other digital material	1. http://nptel.ac.in/courses/106105084/13 2. http://www.w3schools.com/ 3. https://www.javatpoint.com/html-tutorial

19ME2701A– OPTIMIZATION TECHNIQUES

Course Category:	Inter disciplinary Elective –II		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Apply** various Classical optimization techniques	K3
CO2	**Select** suitable Numerical method for optimization of Engineering Problems.	K4
CO3	**Analyze** multi stage decision making process through dynamic programming	K4
CO4	**Enumerate** fundamentals of Integer programming technique	K2

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	2		2		2		2		2	2	2
CO2	2	3	3	2		2		2		2		2	2	2
CO3	2	3	3	2		2		2		2		2	2	2
CO4	2	2	3	2		2		2		2		2	2	2
Avg.	2	2	3	2		2		2		2		2	2	2

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION TO OPTIMIZATION**: Introduction, engineering applications of optimization, statement of an optimization problem-design vector, design constraints, constraint surface, objective function, classification of optimization problems, optimization techniques. **CLASSICAL OPTIMIZATION TECHNIQUES:** Introduction, single variable optimization, multi variable optimization with no constraints, multi variable optimization with equality constraints-Lagrange multiplier method.	CO1
UNIT-2	**NON-LINEAR PROGRAMMING, I**: One Dimensional Minimization Methods: Introduction, unimodal function, elimination methods- unrestricted search, exhaustive search, interval halving method, Fibonacci method, golden section method, interpolation method,	CO2
UNIT-3	**NON-LINEAR PROGRAMMING II:** Direct Search Method- Nelder- Mead Simplex method, Indirect search methods-steepest descent method (Cauchy's method), Newton Method, Marquardt Method	CO3
UNIT-4	**DYNAMIC PROGRAMMING:** Multistage decision processes, Concepts of sub optimization- calculus method and tabular methods, Linear programming as a case of D.P	CO3
UNIT-5	**INTEGER PROGRAMMING**: Introduction, Graphical Representation, Gomory's cutting plane method, Balas algorithm for zero-one programming, Branch-and- bound method, Penalty Function method; Basic approaches of Interior and Exterior penalty function methods.	CO4

Learning Resources

Text Books	1. S.S.Rao, Engineering optimization theory and practice, , 3rd Edition, New age international,2007.

	2. Van Wylen, Fundamentals of Classical Thermodynamics, .John Wylie.
Reference Books	1. H.A.Taha, Operations Research, , 9th Edition, Prentice Hall of India, 2010. 2. F.S.Hillier, and G.J.Lieberman, Introduction to Operations Research, , 7th Edition, TMH, 2009.
E-Resources& other digital material	1. https://nptel.ac.in/courses/111/105/111105039/ 2. https://nptel.ac.in/courses/106/108/106108056/ 3. https://nptel.ac.in/courses/111/104/111104071/ 4. https://nptel.ac.in/courses/112/105/112105235/

19ME2701B– PROJECT MANAGEMENT & OPTIMIZATION

Course Category:	Inter disciplinary Elective –II		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Explain** basics of project management	K2
CO2	**Analyze** activities involved in project.	K4
CO3	**Describe** various project cost management techniques	K2
CO4	**Apply** various Linear programming techniques and sequencing methods	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3			2		2			3	2	2	3
CO2	2	2	3	2	2				2		3	2	2	3
CO3	2	2	3			2		2			3	2	2	3
CO4	2	2	3			2		2			3	2	2	3
Avg.	2	2	3	2	2	2		2	2		3	2	2	3

1- Low	2-Medium	3-High

Course Content

UNIT-1	**CONCEPTS OF PROJECT MANAGEMENT:** Meaning, definition and characteristics of a project, technical and socio-cultural dimensions; project life cycle phases, project planning and graphic presentation; work breakdown structure, manageable tasks; size of network; blow down NW; identity and logic dummy activity; Fulkerson rule for numbering NW; time-scaled NW	CO1
UNIT-2	**NW ANALYSIS:** Network modelling, Probabilistic model-various types of activity times estimation, programme evaluation review techniques (PERT), probability of completing the project, deterministic model- critical path method (CPM), critical path calculation, crashing of simple of networks	CO2
UNIT-3	**PROJECT DURATION AND CONTROL:** Importance and options to accelerate project completion; time cost trade off; fixed variable and total costs; use of floats and cost optimization; project performance measures; project monitoring info and reports; project control process; Gant chart and control chart; cost-schedule S-graph; planned cost of work schedule (PV), budgeted/ earned cost of work completed (EV) and actual cost of work completed (AC); schedule and cost variances (SV, CV) forecasting final project costs.	CO2
UNIT-4	**LINEAR PROGRAMMING:** Linear Programming Problem Formulation, Graphical solution Simplex method, artificial variables techniques-Two–phase method, Big-M method, Duality Principle **SEQUENCING**: Introduction, sequencing of n jobs through two machines, n jobs through three machines –two jobs through 'm' machines	CO3
UNIT-5	**TRANSPORTATION PROBLEM:** Formulation, Optimal solution, U-V method, unbalanced transportation problems, Degeneracy.	CO4

	ASSIGNMENT PROBLEM: Formulation, Optimal solution, Variants of Assignment Problem-Traveling Salesman problem.	
	Learning Resources	
Text Books	1. Prasanna Chandra, Projects Planning, Implementation and Control, Tata McGraw Hill Publishing Company Limited, New Delhi, 1995. 2. Operations Research, by S.D.Sharma, Kedarnath& Ramnath publications (15th edition),2013	
Reference Books	1. Project Management Institute (PMI), A Guide to the Project Management of Knowledge Newton Square, PA, 1996 2. J.R. Meredith and S.J. Mantel, Project Management: A Managerial Approach. John Wiley and Sons, New York, 1995. 3. L.S. Srinath, PERT & CPM Principles & Applications, 3rd edition, East west Press,2001. 4. Operations Research, (2nd edition) by R.Pannerselvam, 2009,PHI Publications, Noida	
E-Resources& other digital material	1. https://nptel.ac.in/courses/105/106/105106149/ 2. https://nptel.ac.in/courses/110/104/110104073/ 3. https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-ce06/ 4. https://nptel.ac.in/courses/112/106/112106134/	

19CS2801A– INTRODUCTION TO PYTHON PROGRAMMING

Course Category:	Inter disciplinary Elective –III		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to:		
CO1	**Understand** the basic constructs of Python Programming.	K2
CO2	**Apply** Python Programming constructs to solve problems and make an effective report.	K3
CO3	**Apply** python packages to write programs for a given application.	K3
CO4	**Analyze** and choose appropriate data structure for solving problems	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	3								3	3				
CO3	3													
CO4		3												
Avg.	3	3							3	3				

1- Low	2-Medium	3-High

Course Content

UNIT-1	**INTRODUCTION TO PYTHON** Features of Python, Writing and Executing First Python Program, Literal Constants, Variables and Identifiers, Reserved Words, Data Types, Input Operation, Operators and Expressions, Operations on Strings, Type Conversion, Conditional statements and iterative statements.	CO1
UNIT-2	**FUNCTIONS IN PYTHON** Functions: Introduction, Built-in Math Functions, User Defined Functions: Function Call, Variable Scope and Lifetime, The return statement, Lambda Functions, Recursive functions Packages in python.	CO2
UNIT-3	**STRINGS AND FILE HANDLING IN PYTHON** **Strings:** Introduction, Built-in String Functions, Slice Operation, Comparing Strings, Iterating String, Regular Expressions. **FILE HANDLING:** open, close, read and write operations.	CO2
UNIT-4	**DATA STRUCTURES IN PYTHON** **Lists:** Accessing values in lists, Nested Lists, Basic List Operations. **Tuples:** Creating Tuple, Accessing values in a tuple, Basic Tuple Operations. **Dictionaries**: Creating and Accessing Dictionaries, Built-in Dictionary functions, List Vs Tuple Vs Dictionary.	CO3
UNIT-5	**PACKAGES:** Numpy -- Create, reshape, slicing, operations such as min, max, sum, search, sort, math functions etc. Pandas -- Read/write from csv, excel, json files, add/ drop columns/rows, aggregations, applying functions Matplotlib -- Visualizing data with different plots, use of subplots.	CO4

Learning Resources

Text Books	1. Python Programming using Problem Solving Approach, Reema Thareja, 2017, OXFORD University Press
	2. Python for Data Analysis, Wes McKinney, 2012, O.Reilly.
Reference Books	1. Core Python Programming, R. Nageswara Rao, 2018, Dreamtech press.
	2. Programming with python, T R Padmanabhan, 2017, Springer.
E-Resources& other digital material	1. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
	2. https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf

19EC2801A– INSTRUMENTATION AND SENSOR TECHNOLOGIES OF CIVIL ENGINEERING APPLICATIONS

Course Category:	Inter disciplinary Elective –III		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	Summarize various performance characteristics of instruments and the quality of measurement	K2
CO2	Interpret the type of transducer based on the transduction principles.	K2
CO3	Identify the relevant transducer for measurement of physical quantities.	K2
CO4	Discover the additional attributes in advanced sensors and their role in Civil Engineering.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1										2
CO2	2	1	2	1										2
CO3	2	1	2	1										2
CO4	2	1	2	1										2
Avg.	2	1	2	1										2

1- Low	2-Medium	3-High

Course Content

UNIT-1	**Introduction:** Definition of sensor/transducer-Block Diagram-elements of measurement system-classification of sensors/transducers-static characteristics-accuracy, precision, resolution, linearity, sensitivity, range, loading effect, threshold, dead time, dead zone, span. **ERRORS IN MEASUREMENT**: True value, static error, static correction, scale range and scale span, error calibration curve, readability, repeatability & reproducibility, drift and noise	CO1
UNIT-2	**RESISTIVE TRANSDUCERS:** Potentiometers-Linear POT, Rotary POT, characteristics of POT. Thermistors- Construction and its Resistance- Temperature characteristics. Thermocouples- Construction and its Resistance-emf characteristics **INDUCTIVE TRANSDUCERS**: Principle of change of self-inductance, Principle of change of mutual inductance, Linear variable differential transformer (LVDT), Rotary variable differential transformer (RVDT).	CO2
UNIT-3	**CAPACITIVE TRANSDUCERS**: Introduction-Variable area type-variable air gap type- differential arrangement in capacitive transducers, variation of dielectric constant for measurement of liquid level, variation of dielectric constant for measurement of displacement, advantages & disadvantages of Capacitive transducers. **PIEZOELECTRICTRANSDUCERS**: Measurement of Force, Modes of operation of Piezoelectric crystals, properties of Piezoelectric crystals, use of Piezoelectric Transducers.	CO2
UNIT-4	**HALL EFFECT TRANSDUCERS:**	

	Hall effect element, Measurement of displacement, current and power.	CO3
	OPTICAL TRANSDUCERS:	
	Vacuum photo emissive cell and its characteristics, semiconductor photo electric transducer- Photo conductive cell and its characteristics, photo diode and its characteristics, photo voltaic cell and its characteristics.	
UNIT-5	**DIGITAL AND SMART SENSORS:** Introduction to digital encoding transducer- digital displacement transducers- shaft encoder-optical encoder, Introduction to Smart Sensors, Overview in Applications of sensors in Civil Engineering.	CO4

Learning Resources

Text Books	1. A.K.Ghosh, "Introduction to Measurements & Instrumentation", IIIrd ed, PHI 2. A.K.Sawhney& Puneet Sawhney, "A Course in MechnanicalMeasuremnets& Instrumentation",Dhanapat Rai & Co. 3. D.V.S.Murty, "Transducers & Instrumentation", PHI.
Reference Books	3. Core Python Programming, R. Nageswara Rao, 2018, Dreamtech press. 4. Programming with python, T R Padmanabhan, 2017, Springer.
E-Resources& other digital material	1. Raman Pallas-Arney& John G.Webster, "Sensors & Signal Conditioning",2012. 2. D.Patranabis, "Sensors and Transducers" 2nd edition., PHI, 2013. 3. BC Nakra, KK Chaudhry "Instrumentation, Measurement and Analysis", 2nd Edition,TMH

19HS2801A– LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Course Category:	Inter disciplinary Elective –III		Credits:		3
Course Type:	Theory		Lecture-Tutorial-Practical:		3-0-0
Prerequisites:	Nil		Continuous Evaluation:		30
			Semester End Evaluation:		70
			Total Marks:		100

Course Outcomes

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

CO1	**Understanding** the fundamental logistics and supply chain management concepts.	K2
CO2	**Apply** knowledge to evaluate and measuring logistics costs and performance.	K3
CO3	**Understanding** the foundational role of logistics as it relates to Source and transportation.	K2
CO4	**Create awareness** on how to align the management of a supply chain with corporate goals and strategies.	K6

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1										2
CO2	2	1	2	1										2
CO3	2	1	2	1										2
CO4	2	1	2	1										2
Avg.	2	1	2	1										2

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**INTRODUCTION TO LOGISTICS MANAGEMENT**: Introduction, Objectives, Concept of Logistics, Objectives of logistics, Types of logistics, Concept of Logistics Management, Evolution of Logistics, Role of Logistics in an Economy, Difference between Logistics and Supply Chain Management.	CO1
UNIT-2	**MEASURING LOGISTICS COSTS AND PERFORMANCE**: The concept of Total Cost analysis – Principles of logistics costing – Logistics and the bottom-line – Impact of Logistics on shareholder value.	CO2
UNIT-3	**LOGISTICS AND SUPPLY CHAIN RELATIONSHIPS**: Benchmarking the logistics process and SCM operations –Mapping the supply chain processes – Supplier and distributor benchmarking–identifying logistics performance indicators – Channel structure.	CO2
UNIT-4	**Sourcing and Transporting:** Sourcing decisions and transportation in supply chain – infrastructure suppliers of transport services – transportation economics.	CO3
UNIT-5	**PRICING PRODUCT AND DOCUMENTATION:** Pricing - Revenue Management Lack of coordination and Bullwhip Effect - Impact of lack of coordination - Documentation - functions and types.	CO4

Learning Resources

Text Books	1. Donald J.Bowersox and David J.Closs: "Logistical Management" The Integrated Supply Chain Process, TMH, 2011. 2. Edward J Bradi, John J Coyle: " A Logistics Approch to Supply Chain Management, Cengage Learning, New Delhi, 2012.
Reference	1. D.K.Agrawal: "Distribution and Logistics Management", MacMillan

Books	Publishers, 2011
	2. Sunil Chopra and Peter Meindl: "Supply chain Management: Strategy, Planning and Operation", Pearson Education, New Delhi 2013
	3. Rahul V Altekar: Supply Chain Management, PHI Learning Ltd, New Delhi, 2009

Course Category:	Inter disciplinary Elective –III		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	Nil		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Develop** an understanding on quality management philosophies and frameworks	K5
CO2	**Acquire** knowledge of quality costs and leadership	K2
CO3	**Illustrate** concepts of customer focus, continuous quality improvement and supplier partnership	K2
CO4	**Explain** TQM tools to improve management processes.	K2
CO5	**Determine** the set of indicators to evaluate performance excellence of an organization	K3

Contribution of Course Outcomes towards achievement of Program Outcomes

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

1- Low	**2-Medium**	**3-High**

Course Content

UNIT-1	**INTRODUCTION:** Definition of Quality, Factors effecting quality, Quality management, Quality Dimensions, four phases of quality, Total Quality, Salient features of Total Quality Management (TQM)-definition of TQM, Elements of TQM, Principles of TQM, Pillars of TQM, Traditional Approach and TQM Approach. **CHARACTERISTICS OF TQM:** TQM Enablers, Approaches, relevance, Barriers to TQM Implementation	CO1
UNIT-2	**QUALITY COSTS:** Cost classification, Basic cost of quality. Applications and Importance of quality cost. **QUALITY LEADERSHIP:** Quality of leadership, Quality of successful leader, leadership for TQM, Deming Philosophy, Contributions of Gurus of TQM	CO2
UNIT-3	**CUSTOMER FOCUS:** Customer Complaints and suggestions, panels, Customer satisfaction, Customer Perception of Quality, Customer driven quality circles, Customer focus and activities, needs and expectations, Organizations action from the customer point of view. **CONTINUOUS QUALITY IMPROVEMENT** – Juran Trilogy, PDCA Cycle, Kaizen-kaizen suggestion's, program introduction at work place, principles of kaizen. Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development	CO2

UNIT-4	**TQM TOOLS:** Benchmarking - Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) - House of Quality, QFD Process, Benefits. Taguchi Quality Loss Function. Total Productive Maintenance (TPM) - Concept, Improvement Needs, FMEA - Stages of FMEA, the seven tools of quality, Process Capability-Concept, Methods of calculating process capability, Process capability index, Concept of six sigma.	CO3
UNIT-5	**NEED FOR ISO 9000 - ISO 9001-2008 QUALITY SYSTEM** Elements, documentation, Quality Auditing – QS 9000 - ISO 14000 - Concepts, Requirements and Benefits – TQM, Implementation in manufacturing and service sectors.	CO4

Learning Resources

Text Books	1. Dale H.Besterfiled, "Total Quality Management", Pearson Education, Delhi, 2006. 2. K. C. Arora, "Total Quality Management", Kataria& sons., New Delhi, 2005.
Reference Books	1. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2005. 2. Narayana V and Sreenivasan N.S., Quality Management - Concepts and Tasks, New Age International, Delhi, 1996.
E-Resources& other digital material	1. https://nptel.ac.in/courses/110/105/110105039/ 2. https://nptel.ac.in/courses/110/104/110104085/ 3. https://nptel.ac.in/courses/110/104/110104080/# 4. https://nptel.ac.in/noc/courses/noc17/SEM2/noc17-mg18/