Structure of Undergraduate Program
(B.E. Civil Engineering)

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

THAPAR INSTITUTE OF ENGINEERING AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

PATIALA, PUNJAB, INDIA

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

CURRICULUM & SCHEME OF COURSES

Bachelor of Engineering

Civil Engineering

2017

Curriculum Development – Guiding Principles

The statutory bodies of the University, the Senate or the Planning and Monitoring Board oversee the design and development process so that the activity is carried out in a planned manner. The detailed planning for this activity is the responsibility of the Department Head. The systematic process of design and development includes the activities & sub activities including techniques & organizational interfaces and the time frame for completion of various activities. The plans are updated, as the instructional design evolves.

The design and development process generally begins with a need analysis report which comprises of (i) Stated needs (ii) Implied needs (iii) Overall goals of Instructions (iv) Relevant standards i.e. AICTE and UGC guidelines and Curricula of Entrance Tests like Indian Engineering Services (IES) and Graduate Aptitude Test for Engineers (GATE), etc. and (v) General characteristics of target population.

Organizational and Technical interfaces between different faculty and external expert groups providing input to the instructional design are defined, committees are constituted and their reports are documented. Faculty members from different disciplines connected with the design & development activity are associated with the process. The updation/restructuring is carried out as the design process progresses. Clear responsibilities are assigned and effective communication is ensured.

The requirements of instructional design are determined and recorded. For instructional design, the input is taken from various sources. Input requirements are clearly understood and reconciled. The design input may come from:

- Need analysis & Reviews.
- Recommendations from
  - Faculty &senior management
  - Employers and industry
  - Alumni
  - Regulatory Bodies
- Success/failure reports of similar courses & programs.
- Published literature relevant to programs.
- Boundary condition w.r.t GATE, IES, IAS curricula etc.

The general steps followed in curriculum development are as under:

- The need for starting a new programme or course(s) may arise from interaction with Industry, Faculty, Students, Alumni or PMB/Senate/BOG, UGC/AICTE etc.
- The idea of proposed programme is discussed in the HODs' meeting and if found appropriate, the Head of concerned department is asked to put up a proper proposal. A sub-committee of internal/external member(s) may sometimes be formed for making the feasibility and viability analysis.
- The DAAC (on the basis of recommendations of sub-committee, wherever required) does the need analysis and prepares the proposal for approval from Board of Studies (BOS).

- The BOS after deliberating on the proposal may make the desired modifications and then send the proposal to DOAA for consideration in SUGC/SPGC, along with the duly filled checklists.
- The proposal is put up for consideration to SUGC/SPGC and upon its approval the recommendations may be sent to the Senate and PMB.
- After the Senate approval, the proposal may be sent to concerned Department/School through academic section for allocation of appropriate course codes OR if required it is sent to AICTE/UGC for approval and the status is put up in the forthcoming meeting of BOG.
- Once approved, it is implemented by the concerned Department/School after allocation of proper course code by the academic section.

The employability, innovation and research in curriculum design and development is ensured by:

- Involvement of industry professionals in curriculum development
- Benchmarking exercises to extract customers (employer's) requirements
- Mandatory project semester in Industry for all UG and some PG students
- Synergizing curriculum with industry practices and needs

The curriculum design and development for all programs is done at least once every four years to ensure continuing suitability, adequacy and effectiveness in satisfying the requirements and the vision, mission and quality policy of the University. The design process includes assessing opportunities for improvement and the need for ensuring suitable employability, innovation and research (more applicable to postgraduate programs). The process invites formal inputs from all stake holders and generally includes the following sources:

- Action taken report on the previous reviews and external accreditation reports (NAAC, NBA-AICTE)
- Results of student's performance in various examinations
- Result of Students Reaction Survey
- Feedback from
  - Industry,
  - Alumni,
  - participating organizations in campus placement and other concerned sources
- Details of corrective/preventive actions
- Improvement programs suggested/recommended
- Training programs launched
- Review of mission and quality policy

The process of determining solutions to satisfy the identified needs is laid down and documented. Instructions are designed by incorporating these solutions. The analysis and mappings are recorded. The design output at this stage is taken as the initial design for subsequent reviews. The output of instructional design & development is documented in the form of a report named "Curriculum and Scheme of Courses". Through various reviews and verifications, it is ensured that the design output meets the design input requirements.

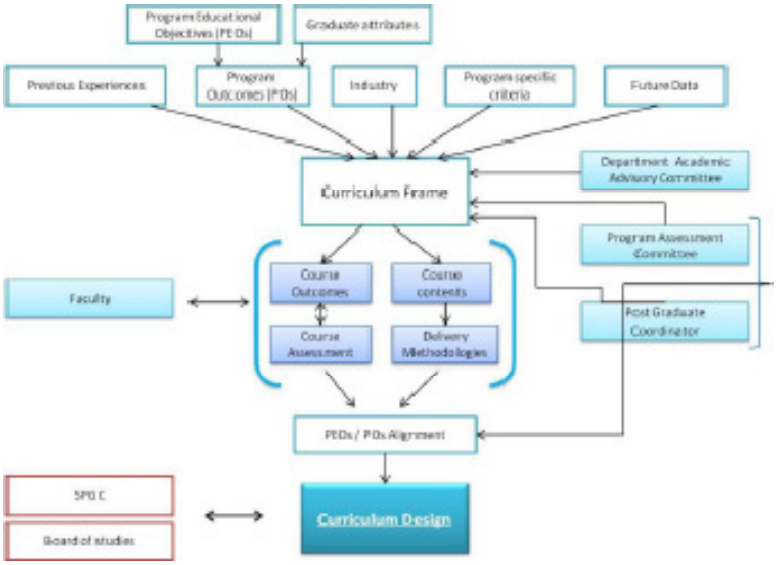
The design output report includes:

- The types and levels of skill and knowledge to be imparted
- Program Educational Objectives; Student Outcomes
- Course Learning Outcomes
- Scheme of courses and the detailed syllabi
- Assessment and evaluation.

The output documents like curriculum and instructional strategies are reviewed and approved before release at various levels and stages.

Reviews are conducted at defined stages of the curriculum Design, in which faculty members from the concerned area as well as experts from amongst the peer group from within and/or outside the University are associated. Records of the reviews are maintained. Based on the reviews, the curriculum is updated.

New/revised curriculum and instructional design is made applicable to the prospective students. The curriculum is validated in the initial stages of its introduction by taking a feedback from students and faculty members regarding the effectiveness and applicability of the curriculum, with regard to the documented needs. Necessary changes, if required, are made to ensure that the design conforms to defined needs of the students. Wherever required, additional instructional sessions and allied inputs are arranged for students/participants.



Some Broad Guidelines

Undergraduate Programs

Undergraduate engineering students are taught a series of courses in basic sciences to develop understanding of scientific principles and methods, analytical ability and rigor. These courses are followed by courses in engineering sciences to provide a smooth transition from basic sciences to professional engineering courses. A series of courses in technical arts are designed to develop engineering skills through training in engineering drawing, measurements, computing skills, manufacturing technology and effective communication. The professional courses in the chosen field of specialization are meant to develop creative abilities for the application of basic and engineering sciences to engineering problems involving planning, design, manufacturing, maintenance and research and development. In addition, courses in humanities and social sciences are incorporated to develop appreciation of the impact of science and technology on society. The undergraduate curriculum consists of two main components i.e. core courses and professional courses. The core courses lay emphasis on concepts and principles. It involves teaching of subjects in Basic Sciences, Humanities and Social Sciences and Engineering Science. Attention is also paid to develop communication skills in English language - the medium of instructions. The Professional courses lay emphasis on system analysis, design, manufacturing and professional practice. There is an in-built flexibility to encourage students to specialize in streams of their choice through a system of professional and free electives. The University strives to foster among its students a strong desire and capacity for continuous learning as well as self-appraisal to develop sterling human & professional qualities and a strong sense of service to society through designed, curricular, co-curricular activities and congenial campus environment.

Post-graduate Programs

MASTER OF ENGINEERING/TECHNOLOGY (M.E./M.Tech.)

The University in offering various M.E./M.Tech. programmes has uniformly maintained the basic structure and philosophy of the post-graduate education in engineering in the country. All these programmes, regular or part-time, have their course work classified into two major categories: Core Courses and Elective Courses. The core courses are aimed at imparting knowledge of the relevant basics analytical-tools & techniques necessary to build-up on them elective (professional) courses. Core courses of a particular programme are compulsory for all the students registered in that programme. Elective courses are of professional nature. To be eligible for a degree, a student must complete requisite number of core and elective courses. However, to bring in flexibility a wide choice of electives is offered to the students in order to make their training broad based. Presentation of a Seminar and a project in addition to the course work and further carrying out a thesis/dissertation are necessary components of post-graduate degree. The seminar and project should be on a topic relevant to the area of study, presenting the state-of-art work done on the subject. The literature survey conducted during the preparation of the seminar should highlight the areas for further research work on the subject. The problem taken up for the thesis/dissertation should be as far as possible on the work done for the seminar.

Both the seminar and thesis/dissertation are submitted in bound form and are presented during their respective evaluation. In case a student fails to undertake, complete & clear thesis work and completes seminar only he will be eligible for award of Post-graduate diploma only.

MASTER OF COMPUTER APPLICATIONS (M.C.A.)

The MCA programme aims to train and produce much needed human resource for software industry as increasing applications of computers in almost all areas of human endeavour has led to a vibrant software industry with concurrent rapid technological changes. The programme is spread over a period of three years consisting of six semesters. The students study courses for five semesters in the University and carryout a Software Development Project (SDP) in the sixth semester in reputed national/multinational companies. The graduates of this programme are absorbed as software professionals, solution developers and system analysts in leading national/multinational companies and other industrial/service organizations working in the area of Information Technology (IT).

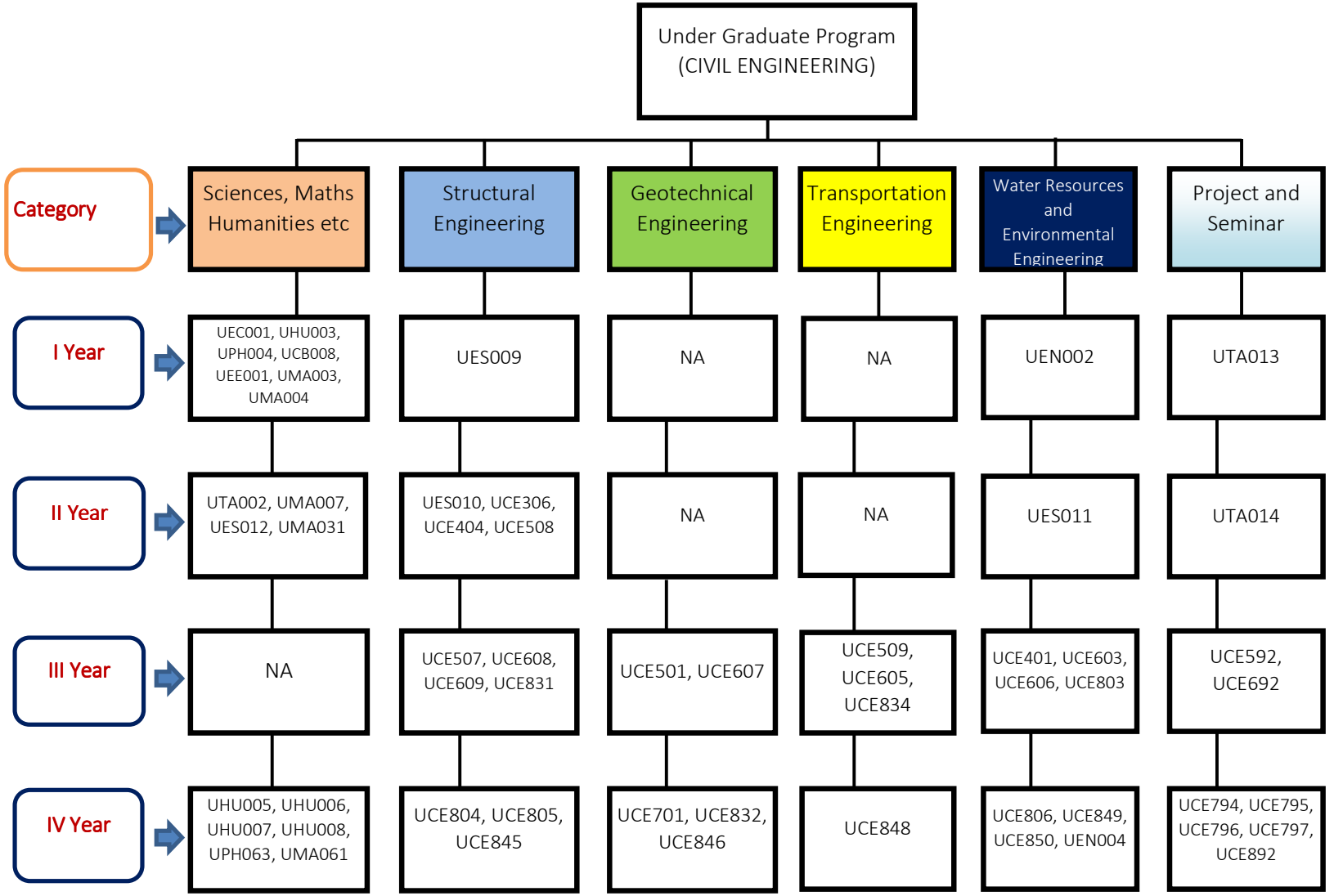
MASTER OF SCIENCE (M.Sc.)

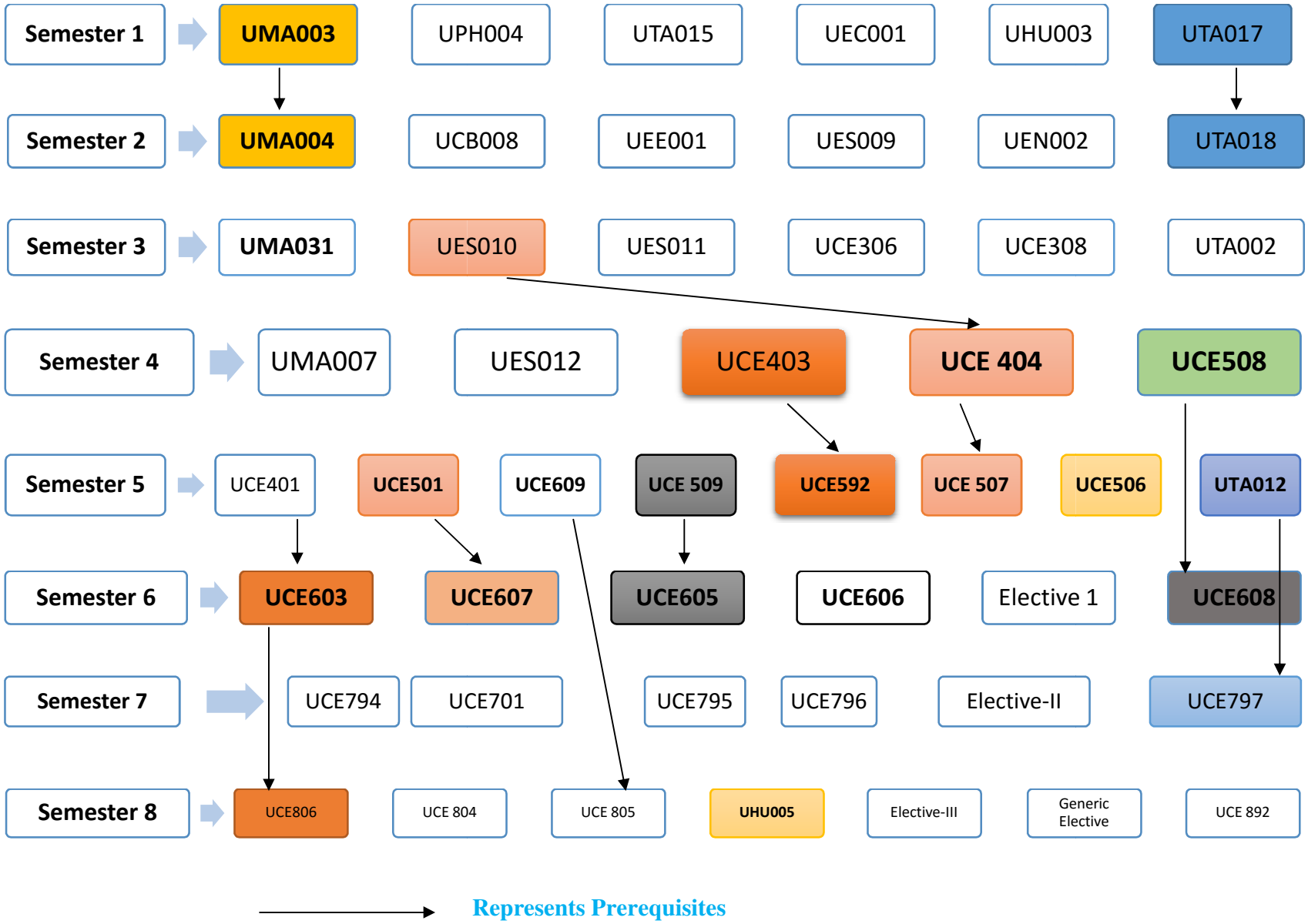
M.Sc. programmes aims to impart application oriented education in the respective area with an integrated approach so as to turn out professionals who will have easy absorbability in industry as well as self-employment skills. The course curriculum has been structured to impart education in the areas desired by the industry as well as local needs. The programme is spread over four semesters which include teaching of both core courses as well as elective courses for first two semesters, a project in the third semester and a dissertation in the final semester.

DOCTORAL PROGRAMME

High caliber students with demonstrated capability can register themselves for Ph.D. degrees. There is a laid down course work requirement for the Doctoral Degree Programme for candidates registering after obtaining M.E. degree. The provisions in the rules and regulations governing the programme, aim at ensuring high quality of research leading to Ph.D. degree. Ph.D. programme are offered on both regular and part-time basis. Ph.D. thesis is evaluated by a panel of examiners drawn from the peer group on the topic, both from India and abroad.

The Program Scheme and inter-relationships are shown below:


Under Graduate Program (CIVIL ENGINEERING)
Category
Sciences, Maths Humanities etc
Structural Engineering
Geotechnical Engineering
Transportation Engineering
Water Resources and Environmental Engineering
Project and Seminar
I Year
UEC001, UHU003, UPH004, UCB008, UEE001, UMA003, UMA004
UES009
NA
NA
UEN002
UTA013
II Year
UTA002, UMA007, UES012, UMA031
UES010, UCE306, UCE404, UCE508
NA
NA
UES011
UTA014
III Year
NA
UCE507, UCE608, UCE609, UCE831
UCE501, UCE607
UCE509, UCE605, UCE834
UCE401, UCE603, UCE606, UCE803
UCE592, UCE692
IV Year
UHU005, UHU006, UHU007, UHU008, UPH063, UMA061
UCE804, UCE805, UCE845
UCE701, UCE832, UCE846
UCE848
UCE806, UCE849, UCE850, UEN004
UCE794, UCE795, UCE796, UCE797, UCE892


Semester 1
UMA003
UPH004
UTA015
UEC001
UHU003
UTA017
Semester 2
UMA004
UCB008
UEE001
UES009
UEN002
UTA018
Semester 3
UMA031
UES010
UES011
UCE306
UCE308
UTA002
Semester 4
UMA007
UES012
UCE403
UCE 404
UCE508
Semester 5
UCE401
UCE501
UCE609
UCE 509
UCE592
UCE 507
UCE506
UTA012
Semester 6
UCE603
UCE607
UCE605
UCE606
Elective 1
UCE608
Semester 7
UCE794
UCE701
UCE795
UCE796
Elective-II
UCE797
Semester 8
UCE806
UCE 804
UCE 805
UHU005
Elective-III
Generic Elective
UCE 892
Represents Prerequisites

COURSES SCHEME & SYLLABUS

B.E. (CIVIL ENGINEERING)

92nd Senate approved Courses Scheme and Syllabus for B.E. Civil Engineering (2017)

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
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COURSE SCHEME

FOR

B.E. – CIVIL ENGINEERING

2017

92nd Senate approved Courses Scheme and Syllabus for B.E. Civil Engineering (2017)

SEMESTER-I

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEC001	ELECTRONIC ENGINEERING	3	1	2	4.5
2	UHU003	PROFESSIONAL COMMUNICATION	2	0	2	3.0
3	UMA003	MATHEMATICS - I	3	1	0	3.5
4	UPH004	APPLIED PHYSICS	3	1	2	4.5
5	UTA015	ENGINEERING DRAWING	2	4	0	4.0
6	UTA017	COMPUTER PROGRAMMING - I	3	0	2	4.0
		TOTAL	**16**	**7**	**8**	**23.5**

SEMESTER-II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCB008	APPLIED CHEMISTRY	3	1	2	4.5
2	UEE001	ELECTRICAL ENGINEERING	3	1	2	4.5
3	UEN002	ENERGY AND ENVIRONMENT	3	0	0	3.0
4	UES009	MECHANICS	2	1	2*	2.5
5	UMA004	MATHEMATICS - II	3	1	0	3.5
6	UTA013	ENGINEERING DESIGN PROJECT – I (6 SELF EFFORT HOURS)	1	0	2	5.0
7	UTA018	OBJECT ORIENTED PROGRAMMING	3	0	2	4.0
		TOTAL	**18**	**5**	**7**	**27.0**

*** Each student will attend one Lab Session of 2 hrs in a semester for a bridge project in this course. (Mechanics)**

SEMESTER-III

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE306	ARCHITECTURE DRAWING & BUILDING CONSTRUCTION	2	0	2	3.0
2	UCE308	BUILDING MATERIALS	2	0	2	3.0
3	UES010	SOLIDS AND STRUCTURES	3	1	2	4.5
4	UES011	THERMO-FLUIDS	3	1	2	4.5
5	UMA031	OPTIMIZATION TECHNIQUES	3	1	0	3.5
6	UTA002	MANUFACTURING PROCESSES	2	0	3	3.5
7	UTA014	ENGINEERING DESIGN PROJECT – II (6 SELF EFFORT HOURS)	1	0	4	6.0
			16	**3**	**15**	**28.0**

SEMESTER-IV

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE403	SURVEYING	3	1	3	5.0
2	UCE404	STRUCTURAL ANALYSIS (7 SELF EFFORT HOURS)	3	1	2	8.0
3	UCE508	DESIGN OF CONCRETE STRUCTURES-I	3	1	0	3.5
4	UES012	ENGINEERING MATERIALS	3	1	2	4.5
5	UMA007	NUMERICAL ANALYSIS	3	1	2	4.5
		TOTAL	**15**	**4**	**9**	**25.5**

SEMESTER-V

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE401	HYDROLOGY AND GROUND WATER	3	1	0	3.5
2	UCE501	SOIL MECHANICS	3	1	2	4.5
3	UCE507	ADVANCED STRUCTURAL ANALYSIS	3	1	0	3.5
4	UCE506	CONSTRUCTION MANAGEMENT	3	1	0	3.5
5	UCE509	TRANSPORTATION ENGINEERING - I	3	0	2	4.0
6	UCE592	SURVEY PROJECT	-	-	-	4.0
7	UCE609	DESIGN OF STEEL STRUCTURES – I	3	1	0	3.5
8	UCE692	GROUP DESIGN PROJECT (START)	-	-	2	-
9	UTA012	INNOVATION AND ENTREPRENRESHIP (5 SELF EFFORT HOURS)	1	0	2	4.5
		TOTAL	**19**	**5**	**6**	**31**

SEMESTER-VI

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE603	HYDRAULIC ENGINEERING	3	1	2	4.5
2	UCE605	TRANSPORTATION ENGINEERING - II	3	1	0	3.5
3	UCE606	WATER AND WASTE WATER ENGINEERING	3	1	2	4.5
4	UCE607	FOUNDATION ENGINEERING	3	1	2	4.5
5	UCE608	DESIGN OF CONCRETE STRUCTURES- II	2	1	0	2.5
6	UCE692	GROUP DESIGN PROJECT (6 SELF EFFORT HOURS)	1	0	2	5.0
7		ELECTIVE-I	3	1	0	3.5
		TOTAL	**18**	**6**	**8**	**28.0**

SEMESTER-VII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE794	PROJECT SEMESTER*	-	-	-	20
		TOTAL	**-**	**-**	**-**	**20**

*TO BE CARRIED OUT IN INDUSTRY/RESEARCH INSTITUTION

OR

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE701	GROUND IMPROVEMENT	3	1	0	3.5
1	UCE795	PROJECT (8 SELF EFFORT HOURS)	1	0	8	9.0
2	UCE796	PRACTICAL TRAINING (SIX WEEKS)	-	-	-	4.0
3		ELECTIVE – II	3	1	0	3.5
		TOTAL	**-**	**-**	**-**	**20**

OR

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE797	START- UP SEMESTER**	-	-	-	20
		TOTAL	**-**	**-**	**-**	**20**

**BASED ON HANDS ON WORK ON INNOVATIONS AND ENTREPRENEURSHIP

SEMESTER-VIII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE804	SEISMIC ANALYSIS AND DESIGN	3	1	2	4.5
2	UCE805	DESIGN OF STEEL STRUCTURES II	3	2	0	4.0
3	UCE806	DESIGN OF HYDRAULIC STRUCTURES	3	1	0	3.5
4	UCE892	CAPSTONE PROJECT (13 SELF STUDY HOURS)	0	0	3	8.0
5	UHU005	HUMANITIES FOR ENGINEERS	2	0	2	3.0
6		ELECTIVE – III	3	1	0	3.5
7		GENERIC ELECTIVE	3	0	0	3.0
		TOTAL	**17**	**5**	**7**	**29.5**

LIST OF PROFESSIONAL ELECTIVES

ELECTIVE I

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE831	BRIDGE ENGINEERING	3	1	0	3.5
2	UCE833	WATER RESOURCES PLANNING AND MANAGEMENT	3	1	0	3.5
3	UCE834	ADVANCED TRANSPORTATION ENGINEERING	3	1	0	3.5
4	UCE847	ENVIRONMENTAL LEGISLATIONAND IMPACT ASSESSMENT	3	1	0	3.5

ELECTIVE II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE723	GROUND WATER ENGINEERING	3	1	0	3.5
2	UCE724	SITE ORGANIZATION AND SAFETY MANAGEMENT IN CONSTRUCTION	3	1	0	3.5
3	UCE725	ADVANCED CONSTRUCTION MATERIALS AND TECHNIQUES	3	1	0	3.5

ELECTIVE II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCE832	GEO-TECHNIQUES	3	1	0	3.5
2	UCE844	REMOTE SENSING AND GIS	3	1	0	3.5
3	UCE845	PRESTRESSED CONCRETE	3	1	0	3.5
4	UCE846	SOIL DYNAMICS AND MACHINE FOUNDATION	3	1	0	3.5
5	UCE848	TRANSPORTATION PLANNING & MANAGEMENT	3	1	0	3.5
6	UCE849	AIR QUALITY & CONTROL ENGINEERING	3	1	0	3.5
7	UCE850	HYDRO POWER ENGINEERING	3	1	0	3.5

GENERIC ELECTIVE

S.NO.	CODE	TITLE	L	T	P	CR
1	UHU006	INTRODUCTORY COURSE IN FRENCH	3	0	0	3.0
2	UCS001	INTRODUCTION TO CYBER SECURITY	3	0	0	3.0
3	UHU007	EMPLOYABILITY DEVELOPMENT SKILLS	2	2	0	3.0
4	UEN004	TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT	3	0	0	3.0
5	UHU008	INTRODUCTION TO CORPORATE FINANCE	3	0	0	3.0
6	UHU009	INTRODUCTION TO COGNITIVE SCIENCE	3	0	0	3.0
7	UPH063	NANO SCIENCE AND NANO-MATERIALS	3	0	0	3.0
8	UMA066	GRAPH THEORY AND APPLICATIONS	3	0	0	3.0
9	UMA061	ADVANCED NUMERICAL METHODS	3	0	0	3
10	UBTXXX	BILOGY FOR ENGINEERS	3	0	0	3

SEMESTER WISE CREDITS FOR BE (CIVIL ENGINEERING)

SEMESTER	CREDITS
FIRST	23.5
SECOND	27.0
THIRD	28.5
FOURTH	25.5
FIFTH	26.5
SIXTH	28.0
SEVENTH	20.0
EIGHTH	29.5
TOTAL CREDITS	**208.5**

SEMESTER-I

UEC001: Electronic Engineering

L	T	P	Cr
3	1	2	4.5

Course Objective: To enhance comprehension capabilities of students through understanding of electronic devices, various logic gates, SOP, POS and their minimization techniques, various logic families and information on different IC's and working of combinational circuits and their applications.

Semiconductor Devices:p- n junction diode: Ideal diode, V-I characteristics of diode, Diode small signal model, Diode switching characteristics, Zener diode

Electronics Devices and Circuits: PN Diode as a rectifier, Clipper and clamper, Operation of Bipolar Junction Transistor and Transistor Biasing, CB, CE, CC (Relationship between α, β, γ) circuit configuration Input-output characteristics, Equivalent circuit of ideal and real amplifiers, Low frequency response of amplifiers, Introduction to Field Effect Transistor and its characteristics

Operational Amplifier Circuits: The ideal operational amplifier, The inverting, non-inverting amplifiers, Op-Amp Characteristics, Frequency response of op-amp, Application of op-amp

Digital Systems and Binary Numbers: Introduction to Digital signals and systems, Number systems, Positive and negative representation of numbers, Binary arithmetic, Definitions and basic theorems of boolean Algebra, Algebraic simplification, Sum of products and product of sums formulations (SOP and POS), Gate primitives, AND, OR, NOT and Universal Gate, Minimization of logic functions, Karnaugh maps.

Combinational and Sequential Logic: Code converters, multiplexors, decoders, Addition circuits and priority encoder,Master-slave and edge-triggered flip-flops,Synchronous and Asynchronous counters, Registers

Logic families:N and P channel MOS transistors, CMOS inverter, NAND and NOR gates, General CMOS Logic, TTL and CMOS logic families, and their interfacing.

Laboratory Work:
Familiarization with CRO, DSO and Electronic Components, Diodes characteristics - Input-Output and Switching, BJT and MOSFET Characteristics, Zener diode as voltage regulator,Rectifiers, Clippers and Clampers, adder circuit implementation, Multiplexer & its application, Latches/Flip-flops, up/down counters.

Course learning outcomes (CLO): The student will be able to:

1. Demonstrate the use of semiconductor diodes in various applications.
2. Discuss and explain the working of transistors and operational Amplifiers, their configurations and applications.
3. Recognize and apply the number systems and Boolean algebra.
4. Reduce Boolean expressions and implement them with Logic Gates.
5. Analyze, design and implement combinational and sequential circuits.
6. Analyze and differentiate logic families, TTL and CMOS.

Text Books:

1. *Milliman, J. and Halkias, C.C., Electronic Devices and Circuits, Tata McGraw Hill, 2007.*
2. *M. M. Mano and M.D. Ciletti, Digital Design, Pearson, Prentice Hall, 2013.*
3. *Boylestad, R.L. and Nashelsky, L., Electronic Devices & Circuit Theory, Perason (2009).*

Reference Books:

1. *Donald D Givone, Digital Principles and Design, McGraw-Hill, 2003.*
2. *John F Wakerly, Digital Design: Principles and Practices, Pearson, (2000).*
3. *N Storey, Electronics: A Systems Approach, Pearson, Prentice Hall, (2009).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessional (May include Assignments/Projects/Tutorials/Quiz(es)/Lab Evaluations)	40

UHU003: PROFESSIONAL COMMUNICATION

L	T	P	Cr
2	0	2	3.0

Course Objective: To introduce the students to effective professional communication. The student will be exposed to effective communication strategies and different modes of communication. The student will be able to analyze his/ her communication behavior and that of the others. By learning and adopting the right strategies, the student will be able to apply effective communication skills, professionally and socially.

Effective Communication: Meaning, Barriers, Types of communication and Essentials, Interpersonal Communication skills.

Effective Spoken Communication: Understanding essentials of spoken communication, Public speaking, Discussion Techniques, Presentation strategies.

Effective Professional and Technical writing: Paragraph development, Forms of writing, Abstraction and Summarization of a text; Technicalities of letter writing, internal and external organizational communication, technical reports, proposals and papers.

Effective non-verbal communication: Knowledge and adoption of the right non verbal cues of body language, interpretation of the body language in professional context. Understanding Proxemics and other forms of non verbal communication.

Communicating for Employment: Designing effective job application letter and resumes; Success strategies for group discussions and Interviews.

Communication Networks in Organizations: Types, barriers, and overcoming the barriers.

Laboratory Work:

1. Pre -assessment of spoken and written communication and feedback.
2. Training for Group Discussions through simulations and role plays.
3. Training for effective presentations.
4. Project based team presentations.
5. Proposals and papers-review and suggestions.

Minor Project (if any): Team projects on technical report writing and presentations.

Course Learning Outcomes (CLO):

1. Understand and appreciate the need of communication training.
2. Use different strategies of effective communication.
3. Select the most appropriate mode of communication for a given situation.
4. Speak assertively and effectively.
5. Correspond effectively through different modes of written communication.
6. Write effective reports, proposals and papers.
7. Present himself/herself professionally through effective resumes and interviews.

Text Books:

1. *Lesikar R.V and Flately M.E., Basic Business Communication Skills for the Empowering the Internet Generation. Tata McGraw Hill. New Delhi (2006).*
2. *Raman,M& Sharma, S., Technical Communication Principles and Practice, Oxford University Press New Delhi.(2011).*
3. *Mukherjee H.S., Business Communication-Connecting at Work, Oxford University Press New Delhi, (2013).*

Reference Books:

1. *Butterfield, Jeff.,Soft Skills for everyone,Cengage Learning New Delhi,(2013).*
2. *Robbins, S.P., &Hunsaker, P.L.,Training in Interpersonal Skills,Prentice Hall of India New Delhi,(2008).*
3. *DiSianza,J.J&Legge,N.J.,Business and PrfofessionalCommunication,Pearson Education India New Delhi,(2009).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	45
3	Sessionals (Group Discussions; professional presentations; panel discussions; public speaking; projects, quizzes)	30

UMA003: MATHEMATICS - I

L	T	P	Cr
3	1	0	3.5

Course Objectives: To provide students with skills and knowledge in sequence and series, advanced calculus and calculus of several variables which would enable them to devise solutions for given situations they may encounter in their engineering profession.

Applications of Derivatives: Mean value theorems and their geometrical interpretation, Cartesian graphing using first and second order derivatives, Asymptotes and dominant terms, Graphing of polar curves, applied minimum and maximum problems.

Sequences and Series: Introduction to sequences and Infinite series, Tests for convergence/divergence, Limit comparison test, Ratio test, Root test, Cauchy integral test, Alternating series, Absolute convergence and conditional convergence.

Series Expansions: Power series, Taylor series, Convergence of Taylor series, Error estimates, Term by term differentiation and integration.

Partial Differentiation: Functions of several variables, Limits and continuity, Chain rule, Change of variables, Partial differentiation of implicit functions, Directional derivatives and its properties, Maxima and minima by using second order derivatives.

Multiple Integrals: Change of order of integration, Change of variables, Applications of multiple integrals.

Course Learning Outcomes (CLO): Upon completion of this course, the students will be able to:

1. apply the knowledge of calculus to plot graphs of functions, approximate functions and solve the problem of maxima and minima.
2. determine the convergence/divergence of infinite series.
3. evaluate multiple integrals and their applications to engineering problems.
4. analyse and design mathematical problems encountered in engineering applications.

Text Books:

1. *Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, Pearson Education (2007).*
2. *Stewart James, Essential Calculus; Thomson Publishers (2007).*

Reference Books:

1. *Wider David V, Advanced Calculus: Early Transcendentals, Cengage Learning (2007).*
2. *Apostol Tom M, Calculus, Vol I and II, John Wiley (2003).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25

UPH004: APPLIED PHYSICS

L	T	P	Cr
3	1	2	4.5

Course Objectives: Introduce the laws of oscillators, acoustics of buildings, ultrasonics, electromagnetic waves, wave optics, lasers, and quantum mechanics and demonstrate their applications in technology. Student will learn measurement principles and their applications in investigating physical phenomenon.

Oscillations and Waves: Oscillatory motion and damping, Applications - Electromagnetic damping – eddy current; ***Acoustics:*** Reverberation time, absorption coefficient, Sabine's and Eyring's formulae (Qualitative idea), Applications - Designing of hall for speech, concert, and opera; ***Ultrasonics:*** Production and Detection of Ultrasonic waves, Applications - green energy, sound signaling, dispersion of fog, remote sensing, Car's airbag sensor.

Electromagnetic Waves: Scalar and vector fields; Gradient, divergence, and curl; Stokes' and Green's theorems; Concept of Displacement current; Maxwell's equations; Electromagnetic wave equations in free space and conducting media, Application - skin depth.

Optics: ***Interference:*** Parallel and wedge-shape thin films, Newton rings, Applications as Non-reflecting coatings, Measurement of wavelength and refractive index. ***Diffraction:*** Single and Double slit diffraction, and Diffraction grating, Applications - Dispersive and Resolving Powers. ***Polarization:*** Production, detection, Applications – Anti-glare automobile headlights, Adjustable tint windows. ***Lasers:*** Basic concepts, Laser properties, Ruby, HeNe, and Semiconductor lasers, Applications – Optical communication and Optical alignment.

Quantum Mechanics: Wave function, Steady State Schrodinger wave equation, Expectation value, Infinite potential well, Tunneling effect (Qualitative idea), Application - Quantum computing.

Laboratory Work:

1 Determination of damping effect on oscillatory motion due to various media.
2 Determination of velocity of ultrasonic waves in liquids by stationary wave method.
3 Determination of wavelength of sodium light using Newton's rings method.
4 Determination of dispersive power of sodium-D lines using diffraction grating.
5 Determination of specific rotation of cane sugar solution.
6 Study and proof of Malus' law in polarization.
7 Determination of beam divergence and beam intensity of a given laser.
8 Determination of displacement and conducting currents through a dielectric.
9 Determination of Planck's constant.

Micro Project: Students will be asked to solve physics based problems/assignments analytically or using computer simulations, etc.

Course Learning Outcomes (CLO):

Upon completion of this course, students will be able to:

1. demonstrate a detailed knowledge of oscillations, ultrasonics, electromagnetic waves, wave optics, lasers, and quantum mechanics;
2. discuss how the laws of physics have been exploited and applied in the development and design of simple engineering systems;
3. collate, analyse and formulate an experimental report with error analysis and conclusions;

Text Books:

1. *Jenkins, F.A. and White, H.E., Fundamentals of Optics, McGraw Hill (2001).*
2. *Beiser, A., Concept of Modern Physics, Tata McGraw Hill (2007).*
3. *Griffiths, D.J., Introduction to Electrodynamics, Prentice Hall of India (1999).*

Reference Books:

1. *Pedrotti, Frank L., Pedrotti, Leno S., and Pedrotti, Leno M., Introduction to Optics, Pearson Prentice Hall™ (2008).*
2. *Wehr, M.R, Richards, J.A., Adair, T.W., Physics of The Atom, Narosa Publishing House (1990).*
3. *Verma, N.K., Physics for Engineers, Prentice Hall of India (2014)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25

UTA015 - ENGINEERING DRAWING

L	T	P	Cr
2	4	0	4

Course Objectives: This module is dedicated to graphics and includes two sections: manual drawing and AutoCAD. This course is aimed at to make the student understand dimensioned projections, learn how to create two-dimensional images of objects using first and third angle orthographic projection as well as isometric, perspective and auxiliary projection, to interpret the meaning and intent of toleranced dimensions and geometric tolerance symbolism and to create and edit drawings using drafting software AutoCAD.

Engineering Drawing

1. Introduction
2. Orthographic Projection: First angle and third angle projection system
3. Isometric Projections
4. Auxiliary Projections
5. Perspective Projections
6. Introduction to Mechanical Drawing
7. Sketching engineering objects
8. Sections, dimensions and tolerances

AutoCAD

1. Management of screen menus commands
2. Introduction to drawing entities
3. Co-ordinate systems: Cartesian, polar and relative coordinates
4. Drawing limits, units of measurement and scale
5. Layering: organizing and maintaining the integrity of drawings
6. Design of prototype drawings as templates.
7. Editing/modifying drawing entities: selection of objects, object snap modes, editing commands,
8. Dimensioning: use of annotations, dimension types, properties and placement, adding text to drawing

Micro Projects /Assignments:

1. Completing the views - Identification and drawing of missing lines in the projection of objects
2. Missing views – using two views to draw the projection of the object in the third view, primarily restricting to Elevation, Plan and Profile views
3. Projects related to orthographic and isometric projections

a. Using wax blocks or soap bars to develop three dimensional object from given orthographic projections
b. Using wax blocks or soap bars to develop three dimensional object, section it and color the section
c. Use of AUTOCAD as a complementary tool for drawing the projections of the objects created in (1) and (2).

4. Develop the lateral surface of different objects involving individual or a combination of solids like Prism, Cone, Pyramid, Cylinder, Sphere, etc.
5. To draw the detailed and assembly drawings of simple engineering objects/systems with due sectioning (where ever required) along with bill of materials.
   e.g. Rivet joints, simple bearing, wooden joints, Two plates connected with nut and bolt etc.

Course Learning Outcomes (CLO):

Upon completion of this module, students will be able to:

1. creatively comprehend geometrical details of common engineering objects
2. draw dimensioned orthographic and isometric projections of simple engineering objects
3. draw sectional views of simple engineering objects.
4. interpret the meaning and intent of toleranced dimensions and geometric tolerance symbolism
5. create and edit dimensioned drawings of simple engineering objects using AutoCAD
6. organize drawing objects using layers and setting up of templates in AutoCAD

Text Books:

1. *Jolhe, D.A., Engineering Drawing, Tata McGraw Hill, 2008*
2. *Davies, B. L., Yarwood, A.,Engineering Drawing and Computer Graphics,* Van Nostrand Reinhold *(UK), 1986*

Reference Books:

1. *Gill, P.S., Geometrical Drawings, S.K. Kataria& Sons, Delhi (2008).*
2. *Gill, P.S., Machine Drawings, S.K. Kataria& Sons, Delhi (2013).*
3. *Mohan, K.R., Engineering Graphics, DhanpatRai Publishing Company (P) Ltd, Delhi (2002).*
4. *French, T. E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company, New Delhi (1986).*
5. *Rowan, J. and Sidwell , E. H., Graphics for Engineers, Edward Arnold, London (1968).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	Mid semester test (formal written test)	25
2	End semester test (formal written test)	40

UTA017: COMPUTER PROGRAMMING-I

L	T	P	Cr
3	0	2	4

Course Objective: This course is designed to explore computing and to show students the art of computer programming. Students will learn some of the design principles for writing good programs.

Introduction to 'C++' programming: Fundamentals, Structure of a C++ program, Compilation and linking processes.

Expressions and Console I/O : Basic Data types, Identifier Names, Variables, Scope, Type qualifiers, Storage class specifier, Constants, Operators, Reading and writing characters, Reading and writing strings, Formatted and console I/O, cin(), cout(), Suppressing input.

Statements: True and False, Selection statements, Iteration statements, Jump statements, Expression statements, Block statements.

Arrays and Strings: Single dimension array, two dimension array, Strings, Array of strings, Multi-dimension array, Array initialization, Variable length arrays.

Structures, Unions, Enumerations, and Typedef: Structures, Array of structures, passing structures to functions, Structure pointers, Arrays and structures within structures, Unions, Bit-fields, Enumerations, typedef.

Introduction to Object Oriented Programming with C++: Objects and Classes, basic concepts of OOPs (Abstraction, Encapsulation, Inheritance, Polymorphism), Constructors/Destructor, Copy constructor, Dynamic Constructor, Overloading (Function and Operator).

Pointers: Pointer variables, Pointer operators, Pointer expressions, Pointers and arrays, multiple indirection, Pointer initialization, Pointers to arrays, dynamically allocated arrays, Problems with pointers, Pointers and classes, pointer to an object, this pointer.

Functions: General form of a function, Understanding scope of a function, Function arguments, Command line arguments, Return statement, Recursion, Function prototype, Pointers to functions, Friend function and class.

Pre-processor and Comments: Pre-processor, #define, #error, #include, Conditional compilation directives, #undef, Single line and multiple line comments.
File I/O: Streams and files, File system basics, fread() and fwrite(), fseek() and random access I/O, fprintf() and fscanf(), Standard streams.

Laboratory Work:

To implement Programs for various kinds of programming constructs in C++ Language.

Course Learning Outcomes (CLO):

On completion of this course, the students will be able to

1. write, compile and debug programs in C++ language.
2. use different data types, operators and console I/O function in a computer program.
3. design programs involving decision control statements, loop control statements and case control structures.
4. understand the implementation of arrays, pointers and functions and apply the dynamics of memory by the use of poiners.
5. comprehend the concepts of structures and classes: declaration, initialization and implementation.
6. apply basics of object oriented programming, polymorphism and inheritance.
7. use the file operations, character I/O, string I/O, file pointers, pre-processor directives and create/update basic data files.

Text Books:

1. *Kanetkar Y., Let Us C++, BPB Publications, 2nded.*
2. *Balaguruswamy E., Object Oriented Programming with C++, McGraw Hill, 2013.*

Reference Books:

1. *Brian W. Kernighan, Dennis M. Ritchie, The C++ Programming Language, Prentice Hall)*
2. *Schildt H., C++: The Complete Reference, Tata Mcgraw Hill, 2003.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	20
2	EST	40
3	Sessional (May include Assignments/Projects/ Tutorials/Quizzes/Lab Evaluations)	40

SEMESTER-II

UCB008: APPLIED CHEMISTRY

L	T	P	Cr
3	1	2	4.5

Course Objective: The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.

Atomic Structure and Bonding: Chemical change; elements, compounds and mixtures, Atomic structure, dual nature of electron, concept of atomic orbitals, Pauli`s Exclusion principle, Concept of chemical bonding: covalent, ionic, metallic, hydrogen bond, Vander Waal`s, Hybridization and shapes of molecule, electronic structure and periodic table.

Chemical Equilibrium: Law of mass action, Factors that influence the position of equilibrium. Ionic equilibria: ionic equilibria in aqueous solutions; strong and weak acids and bases; buffer solution and indicators.

Electrochemistry: Migration of ions, Transference number, Specific, equivalent and molar Conductivity of electrolytic solutions, Conductometric titrations, Electrode potential and types of electrodes, Introduction to galvanic and concentration cells, Liquid junction potential.

Colligative Properties of Dilute Solutions: Depression of freezing point and elevation of boiling point.

Phase Rule: States of matter, Phase, Component and Degree of freedom, Gibbs phase rule, One component and two component systems.

Water Treatment and Analysis: Hardness and alkalinity of water: Units and determination, External and internal method of Softening of water: Lime-soda Process, Ion exchange process, Desalination of brackish water.

Fuels: Classification of fuels, Calorific value, Cetane and Octane number, fuel quality, Comparison of solid liquid and gaseous fuel, properties of fuel, alternative fuels: biofuels, Power alcohol, synthetic petrol.

Application of Atomic and Molecular Spectroscopic Methods: Structure determination of certain model compounds of industrial importance.

Assignments based on working and applications of advanced instruments will be given in the tutorial class.

Laboratory Work:

Electrochemical measurements: Experiments involving use of pH meter, conductivity meter, potentiometer.

Acid and Bases: Determination of mixture of bases

Spectroscopic techniques: Colorimeter, UV-Vis spectrophotometer.

Kinetics: Kinetics of oxidation of iodine ion by peroxydisulphate ion.

Thermochemistry: Cloud point and pour point determination

Water and its treatment: Determination of hardness, alkalinity, chloride, chromium, iron and copper in aqueous medium.

Course Learning Outcomes (CLO):

The students will be able to:

1. analyse trends in periodic table with electronic and atomic structure.
2. interpret phase diagrams of pure and binary substances.
3. demonstrate the working of electrodes and their applications.
4. calculate various parameters defining water and fuel quality
5. identify the various functional groups through IR spectra.
6. carry out basic experimental procedure and to emphasize need for safety and safety procedure in laboratory.

Text Books:

1. *Ramesh, S. and Vairam S. Engineering Chemistry, Wiley India (2012).*
2. *Jain, P.C. and Jain, M. Engineering Chemistry, DhanpatRai Publishing Co. (2005).*
3. *Puri, B.R., Sharma and L.R., Pathania, M.S. Principles of Physical Chemistry, Vishal Publishing Co. (2008).*

Reference Books:

1. *Brown, Holme, Chemistry for engineering students, Thompson.*
2. *Shulz, M.J. Engineering Chemistry, CengageLearnings, (2007).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quiz)	25

UEE001: ELECTRICAL ENGINEERING

L	T	P	Cr.
3	1	2	4.5

Course Objective: To introduce concepts of DC and AC circuits, electromagnetism, single-phase transformers, DC motor and generators.

DC Circuits: Kirchhoff's voltage and current laws; power dissipation; Voltage source and current source; Mesh and Nodal analysis; Star-delta transformation; Superposition theorem; Thevenin's theorem; Norton's theorem; Maximum power transfer theorem; Millman's theorem and Reciprocity theorem; Transient response of series RL and RC circuits.

AC Circuits: Sinusoidal sources, RC, RL and RLC circuits, Concept of Phasors, Phasor representation of circuit elements, Complex notation representation, Single phase AC Series and parallel circuits, power dissipation in ac circuits, power factor correction, Resonance in series and parallel circuits, Balanced and unbalanced 3-phase circuit - voltage, current and power relations, 3-phase power measurement, Comparison of single phase and three phase supply systems.

Electromagnetism: Electromagnetic induction, Dot convention, Equivalent inductance, Analysis of Magnetic circuits, AC excitation of magnetic circuit, Iron Losses, Fringing and stacking, applications: solenoids and relays.

Single Phase Transformers: Constructional features of transformer, operating principle and applications, equivalent circuit, phasor analysis and calculation of performance indices.

Motors and Generators: DC motor operating principle, construction, applications, DC generator operating principle, reversal of energy transfer, applications.

Laboratory Work:
Network laws and theorems, Measurement of R,L,C parameters, A.C. series and parallel circuits, Measurement of power in 3 phase circuits, Reactance calculation of variable reactance choke coil, open circuit and short circuit tests on single phase transformer, Starting of rotating machines, Magnetisation curve of DC generator.

Course Learning Outcome (CLO):
After the completion of the course the students will be able to:

1. Apply networks laws and theorems to solve electric circuits.
2. Represent AC quantities through phasor and compute AC system behaviour during steady state
3. Explain principle and characteristics of Electro-Mechanical energy conversion devices and apply them.

Text Books:

1. *Hughes, E., Smith, I.M., Hiley, J. and Brown, K., Electrical and Electronic Technology, Prentice Hall (2008).*
2. *Nagrath, I.J. and Kothari, D.P., Basic Electrical Engineering, Tata McGraw Hill (2002).*
3. *Naidu, M.S. and Kamashaiah, S., Introduction to Electrical Engineering, Tata McGraw Hill (2007).*

Reference Books:

1. *Chakraborti, A., Basic Electrical Engineering, Tata McGraw–Hill (2008).*
2. *Del Toro, V., Electrical Engineering Fundamentals, Prentice–Hall of India Private Limited (2004)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEN002: ENERGY AND ENVIRONMENT

L	T	P	Cr
3	0	0	3.0

Course Objectives: The exposure to this course would facilitate the students in understanding the terms, definitions and scope of environmental and energy issues pertaining to current global scenario; understanding the value of regional and global natural and energy resources; and emphasize on need for conservation of energy and environment.

Natural Resources: Human settlements and resource consumption; Biological, mineral and energy resources; Land, water and air; Natural resources vis-à-vis human resources and technological resources; Concept of sustainability; Sustainable use of natural resources

Ecology, Structure and Functioning of Natural Ecosystems: Ecology, ecosystems and their structure, functioning and dynamics; Energy flow in ecosystems; Biogeochemical cycles and climate; Population and communities

Agricultural, Industrial Systems and Environment: Agricultural and industrial systems vis-à-vis natural ecosystems; Agricultural systems, and environment and natural resources; Industrial systems and environment

Environment Pollution, Global Warming and Climate Change: Air pollution (local, regional and global); Water pollution problems; Land pollution and food chain contaminations; Carbon cycle, greenhouse gases and global warming; Climate change – causes and consequences; Carbon footprint; Management of greenhouse gases at the source and at the sinks

Energy Technologies and Environment: Electrical energy and steam energy; Fossil fuels, hydropower and nuclear energy; Solar energy, wind energy and biofuels; Wave, ocean thermal, tidal energy and ocean currents; Geothermal energy; Future energy sources; Hydrogen fuels; Sustainable energy

Group Assignments: Assignments related to Sanitary landfill systems; e-waste management; Municipal solid waste management; Biodiversity and biopiracy; Air pollution control systems; Water treatment systems; Wastewater treatment plants; Solar heating systems; Solar power plants; Thermal power plants; Hydroelectric power plants; Biofuels; Environmental status assessments; Energy status assessments, etc.

Course Learning Outcomes (CLO):

After the completion of this course, the student will be able to:

1. outline the scenario of natural resources and their status
2. calculate the flow of energy and mass balance in ecosystems
3. analyse environmental status of human settlements
4. monitor the energy performance of systems

Text Books:

1. *Bharucha, E., Textbook of Environmental Studies, Universities Press (2005).*

2. *Chapman, J.L. and Reiss, M.J., Ecology- Principles and Application, Cambridge University Press (LPE) (1999).*
3. *Joseph, B., Environmental Studies, Tata McGraw-Hill (2006).*
4. *Eastop, T.P. and Croft, D.R. Energy Efficiency for Engineers and Technologists,Longman and Harow (2006).*

Reference Books:

1. *Miller, G.T., Environmental Science- Working with Earth, Thomson (2006).*
2. *Wright, R.T., Environmental Science-Towards a sustainable Future, Prentice Hall (2008).*
3. *O'Callagan, P.W., Energy Management, McGraw Hill Book Co. Ltd. (1993).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessionals (Quizzes/assignments/group presentations)	20

UES009: MECHANICS

L	T	P	Cr
2	1	2*	2.5

(Two hours Lab Once In Semester)

Course Objectives: The objective of this module is to help students develop the techniques needed to solve general engineering mechanics problems. Students will learn to describe physical systems mathematically so that their behaviour can be predicted.

Review of Newton's law of motion and vector algebra:

Equilibrium of Bodies: Free-body diagrams, conditions of equilibrium, torque due to a force, statical determinacy.

Plane Trusses: Forces in members of a truss by method of joints and method of sections.

Friction: Sliding, belt, screw and rolling.

Properties of Plane Surfaces: First moment of area, centroid, second moment of area etc.

Virtual Work: Principle of virtual work, calculation of virtual displacement and virtual work.

Work and Energy: Work and energy, work-energy theorem, principle of conservation of energy, collisions, principles of momentum etc.

Dynamics of Rigid Bodies: Newton's Laws, D'Alembert's Principle, Energy Principles.

Experimental Project Assignment/ Micro Project: Students in groups of 4/5 will do project on

Model Bridge Experiment: This will involve construction of a model bridge using steel wire and wood.

Course Learning Outcomes (CLO):

The students will be able to:

1. Determine resultants in plane force systems
2. Identify and quantify all forces associated with a static framework
3. Solve problems in kinematic and dynamic systems

Text Books:

1. *Shames, I. H. Engineering Mechanics: Dynamics, Pearson Education India (2006).*
2. *Beer, Johnston, Clausen and Staab, Vector Mechanics for Engineers, Dynamics, McGraw-Hill Higher Education (2003).*

Reference Books:

1. *Hibbler, T.A., Engineering Mechanics: Statics and Dynamics, Prentice Hall (2012).*

2. *Timoshenko and Young, Engineering Mechanics, Tata McGraw Hill Education Private Limited, (2006).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	30
2.	EST	45
3.	Sessional (May include Assignments/Projects/Tutorials/Quiz	25

UMA004: MATHEMATICS – II

L	T	P	Cr
3	1	0	3.5

Course Objectives: To introduce students the theory and concepts of differential equations, linear algebra, Laplace transformations and Fourier series which will equip them with adequate knowledge of mathematics to formulate and solve problems analytically.

Linear Algebra: Row reduced echelon form, Solution of system of linear equations, Matrix inversion, Linear spaces, Subspaces, Basis and dimension, Linear transformation and its matrix representation, Eigen-values, Eigen-vectors and Diagonalisation, Inner product spaces and Gram-Schmidt orthogonalisation process.

Ordinary Differential Equations: Review of first order differential equations, Exact differential equations, Second and higher order differential equations, Solution techniques using one known solution, Cauchy - Euler equation, Method of undetermined coefficients, Variation of parameters method, Engineering applications of differential equations.

Laplace Transform: Definition and existence of Laplace transformsand its inverse, Properties of the Laplace transforms, Unit step function, Impulse function, Applications to solve initial and boundary value problems.

Fourier Series: Introduction, Fourier series on arbitrary intervals, Half range expansions, Applications of Fourier series to solve wave equation and heat equation.

Course Learning Outcomes (CLO):
Upon completion of this course, the students will be able to:

1. Solve differential equations of first and 2nd order using various analytical methods.
2. apply methods of Laplace transform and Fourier series to solve initial and boundary value problems, respectively.
3. Solve systems of linear equations using row reduction method
4. analyze vectors algebraically and geometrically in R^n

Text Books:

1. *Simmons, G.F., Differential Equations (With Applications and Historical Notes), Tata McGraw Hill (2009).*
2. *Krishnamurthy, V.K., Mainra, V.P. and Arora, J.L., An introduction to Linear Algebra, Affiliated East West Press (1976).*

Reference Books:

1. *KreyszigErwin, Advanced Engineering Mathematics, John Wiley (2006).*
2. *Jain, R.K. and Iyenger, S.R.K, Advanced Engineering Mathematics, Narosa Publishing House(2011).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25

UTA013: ENGINEERING DESIGN PROJECT-I

L	T	P	Cr
1	0	2	5

Course Objectives: To develop design skills according to a Conceive-Design-Implement-Operate (CDIO) compliant methodology. To apply engineering sciences through learning-by-doing project work. To provide a framework to encourage creativity and innovation. To develop team work and communication skills through group-based activity. To foster self-directed learning and critical evaluation.

To provide a basis for the technical aspects of the project a small number of lectures are incorporated into the module. As the students would have received little in the way of formal engineering instruction at this early stage in the degree course, the level of the lectures is to be introductory with an emphasis on the physical aspects of the subject matter as applied to the 'Mangonel' project. The lecture series include subject areas such as Materials, Structures, Dynamics and Digital Electronics delivered by experts in the field.

This module is delivered using a combination of introductory lectures and participation by the students in 15 "activities". The activities are executed to support the syllabus of the course and might take place in specialised laboratories or on the open ground used for firing the Mangonel. Students work in groups throughout the semester to encourage teamwork, cooperation and to avail of the different skills of its members. In the end the students work in sub-groups to do the Mangonel throwing arm redesign project. They assemble and operate a Mangonel, based on the lectures and tutorials assignments of mechanical engineering they experiment with the working, critically analyse the effect of design changes and implement the final project in a competition. Presentation of the group assembly, redesign and individual reflection of the project is assessed in the end.

Course Learning Outcomes (CLO):

Upon completion of this module, students will be able to:

1. simulate trajectories of a mass with and without aerodynamic drag using a spreadsheet based software tool to allow trajectories be optimized;
2. perform a test to acquire an engineering material property of strength in bending and analyze the throwing arm of the "Mangonel" under conditions of static and dynamic loading;
3. develop and test software code to process sensor data;
4. design, construct and test an electronic hardware solution to process sensor data;
5. construct and operate a Roman catapult "Mangonel" using tools, materials and

assembly instructions, in a group, for a competition;

6. operate and evaluate the innovative redesign of elements of the "Mangonel" for functional and structural performance;

Text Books:

1. *Michael McRoberts, Beginning Arduino, Technology in action publications.*
2. *Alan G. Smith, Introduction to Arduino: A piece of cake, CreateSpace Independent Publishing Platform (2011)*

Reference Book:

1. *John Boxall, Arduino Workshop - A Hands-On Introduction with 65 Projects, No Starch Press (2013)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	-
2	EST	-
3	Sessional: (may include the following) Mechanical Tutorial Assignments Electronics Hardware and software Practical work in Laboratory Assessment of Mechanical contents in Lectures and Tutorials and Electronics contents in Lectures and Practical. Project (Assembly of the "Mangonel", innovative redesign with reflection, prototype competition, Final Presentation and viva-voce	 30 30 10 30

UTA018 - OBJECT ORIENTED PROGRAMMING

L	T	P	Cr
3	0	2	4

Object Oriented Programming with C++: Class declaration, creating objects, accessing objects members, nested member functions, memory allocation for class, objects, static data members and functions. Array of objects, dynamic memory allocation, this pointer, nested classes, friend functions, constructors and destructors, constructor overloading, copy constructors, operator overloading and type conversions.

Inheritance and Polymorphism: Single inheritance, multi-level, multiple inheritance, runtime polymorphism, virtual constructors and destructors.

File handling: Stream in C++, Files modes, File pointer and manipulators, type of files, accepting command line arguments.

Templates and Exception Handling: Use of templates, function templates, class templates, handling exceptions.

Introduction to Windows Programming in C++: Writing program for Windows, using COM in Windows Program, Windows Graphics, User Input

Laboratory work: To implement Programs for various kinds of programming constructs in C++ Language.

COURSE LEARNING OUTCOMES (CLOS):

On completion of this course, the students will be able to

1. Write, compile and debug programs in C++, use different data types, operators and I/O function in a computerprogram.
2. Comprehend the concepts of classes, objects and apply basics of object oriented programming, polymorphism andinheritance.
3. Demonstrate use of filehandling.
4. Demonstrate use of templates and exceptionhandling.
5. Demonstrate use of windows programming concepts usingC++

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	20
2	EST	45
3	Sessionals (Assignments/Projects/ Tutorials/Quizzes/Lab Evaluations)	35

SEMESTER-III

UCE306: ARCHITECTURE DRAWING AND BUILDING CONSTRUCTION

L	T	P/D	Cr
2	0	2	3

Course Objective: To expose students to the concepts of architectural drawings and buildingconstruction.

Introduction to Architecture Drawing: Proportion, orientation, site plan, working drawingBuilding layout, Architectural, structural working drawings, Modular co-ordination and drawing on modules, Building bye-laws.

Foundations: Types spread, arch, combined, cantilevered, Raft, Grillage, Piles & wells,Footings in block cotton soil, Basement & Retaining walls

Masonry: Stone & Brick**:** Brick masonry, Bonds and junctions, Walling, Mud wall, Sun-driedbricks, burnt bricks, stones walling, load bearing & non load bearing brick masonry for multistoried constructions, brick panel walling, reinforced masonry. Bonds & junctions

Prefabricated Construction: Prefabricated components, Assembly at site, Low cost housing &hollow blocks.

Damp Proof Course: Points of its requirement in buildings, D.P.C. at Plinth level, in basementand roof tops etc. joints in prefabricated construction. Anti-termite treatment

Lintels & Arches: Location and construction details in wood, brick, stone and R.C.C.

Stairs & Stair cases: Suitability of location, stairs in multistoried buildings, Residential andpublic buildings, Fire escape, Stairs in timber, stone, brick, RCC and Metal Drawings in Plan elevation and sections. Hand rail & railings, description and sketches of lifts escalators.

Doors &Windows: Details, location in buildings, sizes & construction for wooden & metal,Battened braced, framed, flush and paneled, sliding, folding telescopic, with louvers, collapsible. Windows in timber & Metal casement, double hung, Dormer, Corner, Fanlight, skylight, clear storey, etc. Low cost ideas, Revolving doors, Aluminum door and windows.

Roofing and Flooring: Types of Flooring, Flat roofs: Waffle floor, channels, cored units etc.,inclined roofs, Form Work, Scaffolding, underpinning.

Exercises:

1. Drawings of all the above components e.g. Brick masonry bonds and junctions, DPC, Lintels and Arches, Stairs, Doors & Windows, Roof & roof coverings

2. A plan of building consisting two stories with three/four rooms:

a. Plan, Elevations & Section (Modular)
b. Site Plan (Bye laws application)
c. Foundation for walls – Construction details,
d. Proposed doors – Construction with details,

e. Roof & floor – details in construction
f. Stair case details

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Plan and draw constructional details of different building components
2. Capable of working with an architect and contractor
3. Prepare building plans and other components for a project
4. Capable of supervise building constructions

Text Books:

1. *Singh, Gurcharan, Building Construction Engineering, Standard Book House (1994).*
2. *Sharma, S. K., Building Construction, S. Chand and Company (2012).*

Reference Books:

1. *Kumar, Sushil, Building Construction, Standard Publisher and Distributors (1990).*
2. *Punima, B. C., Building Construction, Laxmi Publishing House (2002).*
3. *Sharma and Kaul, A Text Book of Building Construction, S. Chand and Company (1987)*

Evaluation Scheme:

Sr. No	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UCE308: BUILDING MATERIALS

L	T	P	Cr
2	0	2	3

Course Objectives: To expose students to the various building and general constructionproducts and their associated quality, durability, warrantees and availability.

Cement: Manufacture, basic properties of cement compounds, grades, packing storage, qualitycontrol and curing.

Aggregates: Classification, characteristics, soundness of aggregates, fineness modulus.

Lime & Mortar: Classifications & Properties

Concrete: Introduction, properties of concrete, water cement ratio, workability, compressivestrength, grades, *Production of Concrete*: Batching, mixing, transportation, placing, compaction and curing of concrete, quality control of concrete, concrete mix design. *Introduction to HPC,SCC and FRC*

Admixtures and Superplasticizers: Functions, classification, accelerating admixture, waterreducing admixture, retarding admixture, air-containing admixture.

Bricks: Composition of good brick earth, harmful ingredients, manufacture of bricks,characteristics of good bricks, shapes, classification of bricks as per IS 1077-1985 and testing.

Stones: Classification of rocks, test for stones, characteristics of a good building stone,deterioration of stones, common building stones of India

Timber: Classification and identification of timber, defects in timber, characteristics of goodtimber, seasoning of timber.

Metals: Manufacture of steel, market forms of steel e.g. mild steel and HYSD steel bars, rolledsteel sections. Thermo Mechanically Treated (TMT) Bars.

Miscellaneous Materials: Asphalt, Bitumen, insulating materials, materials for doors andwindows, paints.

Laboratory Work: Tests on: Cement, fine aggregates, coarse aggregates, fresh and hardenedconcretes, tests on bricks, tests on Steel.

Course Learning Outcomes (CLO):
Upon completion of this course, the students will be able to:

1. Evaluate various properties of concrete
2. Evaluate various properties of the basic construction materials such as brick, stone timber, metals

3. Evaluate the properties of miscellaneous materials such as bitumen, paints, distempering, materials for structural repairs
4. Perform various quality control tests for the various civil engineering materials by performing different lab tests on materials.

Text Books

1. *Gambhir M. L., Concrete Technology, Tata McGraw Hill Publishing Co. Ltd., New Delhi(2004).*
2. *Rangawala S. C., Engineering Materials, Charotar Publishing House, Anand (1992).*

Reference Books

1. *Shetty M. S., Concrete Technology: Theory and Practice, S. Chand & Company (2010).*
2. *Kumar Sushil, Engineering Materials, Metropolitan Press (1994).*
3. *Kumar Sushil, Building Construction, Standard Publishers and Distributors (1990).*
4. *Punmia B. C., Building Construction, Laxmi Publishing House (1993).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	40
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	35

UES010: SOLID AND STRUCTURES

L	T	P	Cr
3	1	2	4.5

Course Objectives: This subject aims to develop an understanding of the stresses and strainsthat develop in solid materials when they are subjected to different types of loading and to develop an understanding of the conditions at failure of such materials. Further to this subject aims at to introduce the fundamental concepts of structural mechanics.

Elastic Plastic Behavior

Axial Stress and Strain: Concept of stress, strain, elasticity and plasticity; one-dimensionalstress-strain relationships; Young's modulus of elasticity, shear modulus and Poisson's ratio; two-dimensional elasticity; isotropic and homogeneous materials; ductile and brittle materials; statically determinate and indeterminate problems, compound and composite bars; thermal stresses. Torsion of shafts; buckling of struts, concept of factor of safety.

Shear Force and Bending Moment Diagrams: Types of load on beams, classification ofbeams; axial, shear force and bending moment diagrams: simply supported, overhung and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment, equation of condition, load function equation, qualitative analysis for two-dimensional frames.

Bending & Shear Stresses in beams: Derivation of flexural formula for straight beams, conceptof second moment of area, bending stress calculation for beams of simple and built up sections, Flitched beams. Shear stress formula for beams, shear stress distribution in beams **Transformation of Stress and Strain:** Transformation equations for plane stress and planestrain, Mohr's stress circle, relation between elastic constants, strain measurements, strain rosettes.

Deformations: Governing differential equation for deflection of straight beams having constantflexural rigidity, double integration and Macaulay's methods for slopes and deflection, unit load method for deflection of trusses

Laboratory Work

Experimental project assignment: Students in groups of 4/5 will do projects:

1. Calculation of tensile strength using UTM
2. Buckling of struts
3. Experimental verification of Theory of bending (Calculation of bending stress and deflections at various points in the beam theoretically and verifying the same experimentally) and indirect evaluation of the modulus of elasticity.
4. Torsion: Study the behavior of circular shafts under torsion and analysis of failure and indirect evaluation of the modulus of rigidity.

Micro Project:

Model Bridge Experiment: This will involve construction of a model bridge using steel wire and wood.

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Evaluate axial stresses and strains in various determinate and indeterminate structural systems
2. Draw Shear Force Diagram and Bending Moment Diagram in various kinds of beams subjected to different kinds of loads
3. Calculate load carrying capacity of columns and struts and their buckling strength
4. Evaluate various kinds of stresses (axial, bending, torsional and shearing) in various structural elements due to different type of external loads.
5. Determine deformations and deflections in various kinds of beams and trusses

Text Books :

1. *Popov, E.P. and Balan, T.A., Engineering Mechanics of Solids, Prentice Hall of India (2012).*
2. *Singh, D.K., Mechanics of Solids, Pearson Education (2008).*

Reference Books :

1. *Shames, I. H. and Pitarresi, J. M., Solid Mechanics, Prentice Hall of India (1996).*
2. *Crandall, S.H., Dahl, N.C. and Lardner, T.J., An Introduction to Mechanics of Solids, McGraw Hill International, Tokyo(1969)*

Evaluation Scheme

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	25

2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quiz/Lab evaluations)	40

UES011:THERMO-FLUIDS

L	T	P	Cr
3	1	2	4.5

Course Objective
To understand basic concepts of fluid flow and thermodynamics and their applications in solving engineering problems

Fluid Mechanics

- **Introduction**: Definition of a fluid and its properties
- **Hydrostatics**: Measurement of pressure, thrust on submerged surfaces
- **Principles of Fluid Motion**: Description of fluid flow; continuity equation; Euler and Bernoulli equations; Pitot total head and static tubes, venturi-meter, orifice-meter, rotameter; Momentum equation and its applications
- **Pipe Flow**: Fully developed flow; laminar pipe flow; turbulent pipe flow, major and minor losses; Hydraulic gradient line (HGL) and total energy line (TEL)
- **Boundary Layer**: Boundary layer profile; displacement, momentum and energy thickness

Thermodynamics

- **Introduction**: Properties of matter, the state postulate, energy, processes and thermodynamic systems;
- **Properties of Pure Substances**: property tables, property diagrams, phase change, equations of state (ideal gas);
- **Energy**: Energy transfer by heat, work and mass;
- **First Law of Thermodynamics**: Closed system, open system, steady-flow engineering devices;
- **Second Law of Thermodynamics**: Statements of the Second Law, heat engines, refrigeration devices, reversible versus irreversible processes, the Carnot cycle.

Laboratory/Project programme

List of Experiments

1. Verification of Bernoulli's theorem
2. Determination of hydrostatic force and its location on a vertically immersed surface
3. Determination of friction factor for pipes of different materials
4. Determination of loss coefficients for various pipe fittings
5. Verification of momentum equation
6. Visualization of laminar and turbulent flow, and rotameter
7. Calibration of a venturi-meter
8. Boundary layer over a flat plate

Sample List of Micro-Projects

Students in a group of 4/5 members will be assigned a micro project.

1. Design a physical system to demonstrate the applicability of Bernoulli's equation
2. Determine the pressure distribution around the airfoil body with the help of wind tunnel
3. Demonstrate the first law of thermodynamics for an open system, for example: a ordinary hair dryer
4. Develop a computer program for solving pipe flow network.

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. analyze and solve problems of simple fluid based engineering systems including pressures and forces on submerged surfaces
2. analyze fluid flow problems with the application of the mass, momentum and energy equations
3. evaluate practical problems associated with pipe flow systems
4. conceptualize and describe practical flow systems such as boundary layers and their importance in engineering analysis
5. estimate fluid properties and solve basic problems using property tables, property diagrams and equations of state
6. analyze and solve problems related to closed systems and steady-flow devices by applying the conservation of energy principle
7. analyze the second law of thermodynamics for various systems and to evaluate the performance of heat engines, refrigerators and heat pumps.

Textbooks

1. *Kumar, D. S, Fluid Mechanics and Fluid Power Engineering, S. K. Kataria (2009)*
2. *Cengel and Boles, Thermodynamics: an Engineering Approach, McGraw-Hill (2011)*

Reference Books

1. *Jain, A. K. , Fluid Mechanics: including Hydraulic Machines, Khanna Publishers (2003)*
2. *Rao, Y.V. C, An Introduction to Thermodynamics, Universities Press (2004*

UMA031 OPTIMIZATION TECHNIQUES

L	T	P	Cr
3	1	0	3.5

Course Objective: The main objective of the course is to formulate mathematical models and to understand solution methods for real life optimal decision problems. The emphasis will be on basic study of linear programming problem, Integer programming problem, Transportation problem, Two person zero sum games with economic applications and project management techniques using PERT and CPM.

Scope of Operations Research: Introduction to linear and non-linear programming formulation of different models.

Linear Programming: Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex method, Exceptional cases in LP, Duality theory, Dual simplex method, Sensitivity analysis.

Integer Programming: Branch and bound technique.

Transportation and Assignment Problem: Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solutions.

Project Management: Construction of networks, Network computations, Floats (free floats and total floats), Critical path method (CPM), Crashing.

Game Theory: Two person zero-sum game, Game with mixed strategies, Graphical method and solution by linear programming.

Course learning outcome: Upon Completion of this course, the students would be able to:

1) formulate and solve linear programming problems.
2) solve the transportation and assignment problems
3) solve the Project Management problems using CPM
4) to solve two person zero-sum games

Text Books:

1) Chandra, S., Jayadeva, Mehra, A., Numerical Optimization and Applications, Narosa Publishing House, (2013).
2) Taha H.A., Operations Research-An Introduction, PHI (2007).

Recommended Books:

1) Pant J. C., Introduction to optimization: Operations Research, Jain Brothers (2004)
2) BazaarraMokhtar S., Jarvis John J. and ShiraliHanif D., Linear Programming and Network flows, John Wiley and Sons (1990)
3) Swarup, K., Gupta, P. K., Mammohan, Operations Research, Sultan Chand & Sons, (2010).

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May includeassignments/quizzes)	25

UTA002: MANUFACTURING PROCESSES

L	T	P	Cr
2	0	3	3.5

Course Objectives: This course introduces the basic concepts of manufacturing via machining, forming, joining, casting and assembly, enabling the students to develop a basic knowledge of the mechanics, operation and limitations of basic machining tools. The course also introduces the concept of metrology and measurement of parts.

Machining Processes: Principles of metal cutting, Cutting tools, Cutting tool materials and applications, Geometry of single point cutting tool, Introduction to multi-point machining processes – milling, drilling and grinding, Tool Life, Introduction to computerized numerical control (CNC) machines, G and M code programming for simple turning and milling operations, introduction of canned cycles.

Metal Casting: Principles of metal casting, Introduction to sand casting, Requisites of a sound casting, Permanent mold casting processes.

Metal Forming: Forging, Rolling, Drawing, Extrusion, Sheet Metal operations.

Joining Processes: Electric arc, Resistance welding, Soldering, Brazing.

Laboratory Work:

Relevant shop floor exercises involving practices in Sand casting, Machining, Welding, Sheet metal fabrication techniques, CNC turning and milling exercises, Experiments on basic engineering metrology and measurements to include measurements for circularity, ovality, linear dimensions, profiles, radius, angular measurements, measurement of threads, surface roughness.

Basic knowledge and derivations related to above measurements, uncertainties, statistical approaches to estimate uncertainties, Line fitting, static and dynamic characteristics of instruments will be discussed in laboratory classes.

Assignments: Assignments for this course will include the topics: Manufacturing of micro-chips used in IT and electronics industry and use of touch screens. Another assignment will be given to practice numerical exercises on topics listed in the syllabus.

Micro Project: Fabrication of multi-operational jobs using the above processes as per requirement by teams consisting of 4-6 members. The use of CNC machines must be part of micro project. Quality check should be using the equipment available in metrology lab.

Course Learning Outcomes (CLO):
After the completion of this module, students will be able to:

- develop simple CNC code, and use it to produce components while working in groups.
- analyse various machining processes and calculate relevant quantities such as velocities, forces.
- recognise cutting tool wear and identify possible causes and solutions.

- understand the basic principle of bulk and sheet metal forming operations for analysis of forces.
- analyse various shearing operations for tooling design.
- apply the knowledge of metal casting for different requirements.
- analyse and understand the requirements to achieve sound welded joint while welding different similar and dissimilar engineering materials.

Text books:

1. *Degarmo, E. P., Kohser, Ronald A. and Black, J. T., Materials and Processes in Manufacturing, Prentice Hall of India (2008) 8thed.*
2. *Kalpakjian, S. and Schmid, S. R., Manufacturing Processes for Engineering Materials, Dorling Kingsley (2006) 4thed.*

Reference Books:

1. *Martin, S.I., Chapman, W.A.J. , Workshop Technology, Vol.1 & II, Viva Books (2006) 4 th ed.*
2. *Zimmer, E.W. and Groover, M.P., CAD/CAM - Computer Aided Designing and Manufacturing, Dorling Kingsley (2008).*
3. *Pandey, P.C. and Shan, H. S., Modern Machining Processes, Tata McGraw Hill (2008).*
4. *Mishra, P. K., Non-Conventional Machining, Narosa Publications (2006).*
5. *Campbell, J.S., Principles of Manufacturing, Materials and Processes, Tata McGraw Hill Company (1999).*
6. *Lindberg, Roy A., Processes and Materials of Manufacture, Prentice Hall of India (2008) 4 thed.*

Evaluation Scheme:

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25
2	EST	40
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	35

UTA014 - ENGINEERING DESIGN PROJECT-II
(Includes project with 6 self-effort hours)

L	T	P	Cr
1	0	4	6.0

Course Objective: Understanding of Arduino microcontroller architecture and programming, Interfacing of Arduino board with various I/O devices. Serial data transmission using Arduino board.Learning of ARM processor Instruction set and programming concepts.

Arduino Microcontroller:
Features of Ardunio Microcontroller, Architecture of Arduino, Different boards of Arduino, Arduino Interfacing and Applications, Anatomy of an Interactive Device like Sensors and Actuators, A to D converters and their comparison, Blinking an LED, LCD Display, Driving a DC and stepper motor, Temperature sensors, Serial Communications, Sending Debug Information from Arduino to Your Computer, Sending Formatted Text and Numeric Data from Arduino, Receiving Serial Data in Arduino, Sending Multiple Text Fields from Arduino in a Single Message, Receiving Multiple Text Fields in a Single Message in Arduino. Light controlling with PWM.

Introduction to ARM processor: Features of ARM processor, ARM Architecture, Instruction set, ARM Programming

Programming of Arduino: The Code designing step by step. Taking a Variety of Actions Based on a Single Variable, Comparing Character and Numeric Values, Comparing Strings, Performing Logical Comparisons, Performing Bitwise Operations, Combining Operations and Assignment, Using Embedded techniques to program Arduino microcontroller, Understanding the libraries of Arduino programming language and applying for circuit design
Laboratory work: Introduction to Arduinoboard. Programming examples of Arduino board. Interfacing of LED, seven segment display, ADC and DAC with Arduino board. Introduction to ARM processor kit.
Projects: Arduino and ARM based projects to be allocated by concerned faculty.

Course Learning Outcomes: The student should be able to:

1. understand of features of Arduino board.
2. analyze of internal Architecture of Arduino board.
3. applyArduino board programming concepts.
4. design and implement Buggy project based on different goals and challenges defined.

Text Books:

1. *Michael McRoberts, Beginning Arduino, Technology in action publications.*
2. *Alan G. Smith, Introduction to Arduino: A piece of cake, CreateSpace Independent Publishing Platform (2011)*

Reference Book:

1. *John Boxall, Arduino Workshop - A Hands-On Introduction with 65 Projects, No Starch Press; 1 edition (2013).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	Mid Semester evaluation 1	20
2.	Mid Semester evaluation 2	20
3.	Mid Semester evaluation 3	20
4.	End Semester Evaluation	40

SEMESTER-IV

UCE403: SURVEYING

L	T	P	Cr
3	1	3	5

Course objective: Surveying as a subject in civil engineering aims to provide basic knowledgeabout principles of surveying for a location, and its application in design and construction of engineering projects. The students develop skills using surveying instruments including measuring tapes, theodolites, and advanced measurement equipment such as total stations.

Surveying: Definition, classification of surveys, Principle, distorted or shrunk scales, precisionin surveying.

Chain Surveying: Instruments for measuring distances, chains, tapes, ranging–direct &indirect, chaining on sloping ground, mistakes in chaining, corrections for linear measurements. Reconnaissance, station selection, limiting length of offsets, field notes.

Compass Traversing: Instruments used in traversing, bearings, meridians, declination, dip ofmagnetic needle, bearing of lines from included angles, local attraction, closing error and its removal.

Plane Table Surveying: Introduction to plane table surveying, principle, instruments, workingoperations, setting up the plane table, centering, leveling, Orientation, methods of plane table survey, two and three point problems, danger circle, Lehmann's Rules, errors.

Leveling: Definitions of terms used in leveling, different types of levels, parallax, staves,adjustments, bench marks, classification of leveling, booking and reducing the levels, rise and fall method, line of collimation method, errors in leveling, permanent adjustments, corrections to curvature and refraction, setting out grades, longitudinal leveling.

Contours: Definition, representation of reliefs, horizontal equivalent, contour interval,characteristics of contours, methods of contouring, contour gradient, uses of contour maps.

Theodolite: Types of theodolities, measurement of angles, temporary and permanentadjustments, closed & open traverse, omitted measurements, consecutive and independent co-ordinates, advantages and disadvantages of traversing closing error, Bowditch & Transit Rules

Tacheometry: Definitions and terms used in tacheometery, difference between theodolite and tacheometer, principle of tacheometry, determination of constants, angular tacheometry with staff vertical and staff inclined, Merits and Demerits; Anallatic lens, tangential method of tachometry, subtense method of tacheometry.

Trigonometric Leveling: Definitions & terms, curvature & refraction Methods: direct &reciprocal, eye and object correction, coefficient of refraction.

Curves setting: Definition, elements of a simple curve, different methods of setting out a simplecircular curve, elements of a compound curve, reverse curves, transition curves, their characteristics and setting out, vertical curves, setting out vertical curves, sight distances.

Total Station: Working principle and survey with total station.

Global Positioning Systems (GPS): Working principle, Types of GPS, Corrections, Applicationof GPS. DGPS-working principle.

Digital Elevation model: Introduction and application

Field astronomy: Introduction, basic principle and application

Remote sensing: Basic concepts, Principle and applications

Photogrammetry*:* Concepts and application for map preparation

Laboratory work

1. Measurement of distances / offsets. With chain and tape
2. Leveling Exercises.
3. Measurement of vertical and horizontal angles with theodolite.
4. Tacheometric Survey and Tacheometric Constants.
5. Plane table survey of an area.
6. Setting out curves.
7. Fixing points with DGPS and survey with DGPS
8. Surveying with Total Station.
9. Layout of building in the field using Total Station

Course learning outcome (CLO):

Upon completion of this course, the students will be able to:

1. Survey an area under various topography and obstructions.
2. Prepare the plan or map of the area surveyed.
3. Analyse, report and where appropriate distribute the survey errors.
4. Set out curve and building lay out.
5. Perform instruments checks to ensure they meet the specifications.

Text Books:

1. *Subramanian, R. Surveying and Leveling*, Oxford (2007).
2. *Venkatramaiah, C., A Text Book of Surveying, Universities Press (1996).*

3. Kanetkar, T.P., and Kulkarni, S.L., Surveying and Leveling Part I and II, Pune Vidhyarthi Griha Prakashan (2006).

Reference Books:

1. *Punmia, B.C., Jain, Ashok Kumar and Jain, Arun Kumar, Surveying Vol. I and II, Laxmi Publications (2005)*
2. *Agor, R., Surveying, Khanna Publishers (1982).*
3. *Singh, Narinder, Surveying, Tata McGraw Hill (1992).*

Evaluation Scheme:

Sr. No	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluation)	40

UCE404: STRUCTURAL ANALYSIS

L	T	P	Cr
3	1	2	8

Course Objective: This course aims to develop an understanding of the techniques of structuralanalysis used to calculate the member forces, stresses, strains and displacements of statically determinate and indeterminate structures. This is followed by an understanding of the influence lines for determinate structures.

Displacements: Geometric methods : Moment area method and conjugate bean method; EnergyMethods: Strain energy in members, Betti's and Maxwell's Laws of reciprocal deflections, Concept of Virtual work and its applications, Castigliano's theorems, Unit load method for 2D-frames.

Indeterminate Structures: Introduction, Static and kinematic indeterminacies, Stability ofstructures, Internal forces in two and three-dimensional structures.

Analysis of Indeterminate Beams and Frames: Classical Methods: Methods of consistentdeformation, Method of least work, and Theorem of three moments; Conventional methods of Analysis of rigid frames: Slope deflection method, Moment distribution method; Approximate methods: Portal method, and Cantilever method.

Moving Loads and Influence Line Diagrams for Statically Determinate Structures: Bendingmoment and shear force diagrams due to single and multiple concentrated rolling loads and uniformly distributed moving loads, Equivalent UDL, Muller Breslau principle**:** Influence lines for beams, Girders with floor beams and pin jointed frames calculations of the maximum and absolute maximum, shear force and bending moment envelopes.

Laboratory Work:

List of Experiments:

1. To verify Betti's Law
2. To find the deflection of a pin connected truss.
3. To determine the flexural rigidity (EI) of a given beam.

Experimental Project/assignment/Micro Project: Students in a group will do the followingproject:

5. Design and build a lightweight "pop up shelter".
6. Design and construct a 2 m simply supported beam made from newspaper s (6no) to support 3 kg (baby monkey).The structure will be constructed from pin jointed ties and struts made from news papers. The project will be completed in two stages:

Stage One: Design Exercises: Design and Testing Structures [Wks 3 to 6]

Stage Two: Construction: Manufacture and Build Final Structure [Wks 8 to 13]

The evaluation will be based on following:

Group Assignments (70%)

Week 6: Group design and structural testing report (25%)

Week 10: Structure construct (15%)

Week 11: Group construction report (25%)

Week 12: Video (5%)

Individual Assignment – Obligatory (30%)

Week 2 to 12: Design Journal

[Design (15%) & Construction (15%)]

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Calculate deformation of statically determinate structures using geometric and energy methods.
2. Analyze statically indeterminate beams using classical and conventional methods.
3. Develop qualitative diagrams showing the displaced shape, bending moments and support reactions for an indeterminate plane fram**e**.
4. Draw influence line diagrams for statically determinate beams and frames.

Text Books:

1. *Wang, C. K., Indeterminate Structural Analysis, Tata McGraw-Hill Education Pvt. Ltd (1983).*
2. *Norris & Wilbur, Elementary Structural Analysis, McGraw Hill Publisher (1983).*

Reference Books:

1. *Dayaratnam, P., Advanced Structural Analysis, Tata McGraw Hill Publishers (1983).*
2. *Punmia, B. C. and Jain, A. K., Theory of Structures, Luxmi Publications (2003).*

Evaluation Scheme

Sr. No.	Evaluation Elements	Weights (%)
1.	MST	15
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quiz/Lab evaluations	10
4.	Project	40

UCE508:DESIGN OF CONCRETE STRUCTURES-I

L	T	P	Cr
3	1	0	3.5

Course Objective: To expose the students to design philosophies & methodologies of variousmethods of design for reinforced concrete elements.

Introduction*:*Reinforced concrete, definition, properties of materials, grades of concrete andreinforcing steel, stress-strain curves, permissible stresses, shrinkage, creep, design philosophies working stress design, ultimate strength and limit state design method.

Limit State Design Method: Introduction, Limit States, Characteristic values, characteristicstrength, characteristic loads, design values for materials and loads, factored loads.

Limit State of Collapse (Flexure): Types of failures, assumptions for analysis and design ofsingly reinforced, doubly reinforced sections, and flanged sections, Design of Lintels, Design of one-way slabs and two-way rectangular slabs, Circular slabs: Slabs with different edge conditions

Limit State of Collapse (Shear, bond and torsion): Introduction - Design for shear, structuralcomponents subjected to torsion, design of rectangular beam section for torsion, development length, continuation of reinforcement (beyond cut off points).

Limit State of Serviceability*:*Deflection, effective span to effective depth ratio, modificationfactors for singly reinforced, doubly reinforcement and flanged beams, crack formation and its control.

Limit State of Collapse (Compression): Columns and their classification, reinforcement incolumns, assumptions, short and long (both tied and helical) columns subjected to axial load, short columns subject to axial, uniaxial and biaxial bending, Interaction Diagrams

Limit State Design of miscellaneous structures: Design of isolated footings, Design ofstaircases.

Introduction to Working Stress Design Method

Application of SP 16 and Detailing of Reinforcement: Use of SP: 34, Codal Provision for RC Elements: (I) General (II) for ductility.

Project Work:

Project would be based on "Design of Concrete Mixes of Different Grades, Study of Strength Properties and Flexural Behaviour of RCC Beams"

1. Design and development of Concrete Mix of a particular Grade of concrete
2. At the age of 28 days, measurement of strength properties such as Compressive Strength, Splitting Tensile Strength, Flexural strength, and Modulus of Elasticity.
3. Study of behaviour of any one type of the RCC beams made of same grade of concrete, subjected to flexure.
    a) Balanced Section
    b) Under - reinforced Section
    c) Over - reinforced Section

Course learning Outcome (CLO):

Upon completion of this course, the students will be able to:

1. Design and detail flexural elements such as beams, slabs etc.
2. Design the flexural member for shear ,bond and torsion
3. Design and detail compression members
4. Design other elements such as footings, stair-case

Text Books:

1. *Gambhir, M. L., Reinforced Concrete Design, Prentice Hall of India(2013).*
2. *Jain, A. K., Limit State Design of Reinforced Concrete, Nem Chand Brothers(2002).*
3. *Ram Chandra, Limit State Design, Standard Book House(2011).*

Reference Books:

1. *Pillai &Menon, Reinforced Concrete Design, Tata McGraw Hill Publishers(2005).*
2. *Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall of India(2008).*
3. *Sinha, S. N. and Roy, Fundamentals of Reinforced Concrete, S Chand Publishers(2014).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	24
2.	EST	36
3.	Sessionals, Lab Project, Assignments/Tutorials, /Quiz	40

UES012: ENGINEERING MATERIALS

L	T	P	Cr
3	1	2	4.5

Course Objectives: The objective of the course is to provide basic understanding of engineering materials, their structure and the influence of structure on mechanical, chemical, electrical and magnetic properties.

Structure of Solids: Classification of engineering materials, Structure-property relationship in engineering materials, Crystalline and non-crystalline materials, Miller Indices, Crystal planes and directions, Determination of crystal structure using X-rays, Inorganic solids, Silicate structures and their applications. Defects; Point, line and surface defects.

Mechanical Properties of Materials: Elastic, Anelastic and Viscoelastic behaviour, Yielding and yield strength, Tensile strength, Stiffness, Ductility, Brittleness, Resilience, Toughness, True stress - true strain relationship, Hardness, Shrinkage, Plastic deformation by twinning and slip, Movement of dislocations, Critical shear stress, Strengthening mechanism, and Creep.

Equilibrium Diagram: Solids solutions and alloys, Gibbs phase rule, Examples and applications of phase diagrams like Iron - Iron carbide phase diagram.

Electrical and Magnetic Materials: Conducting and resister materials, and their engineering application; Semiconducting materials, their properties and applications; Magnetic materials, Soft and hard magnetic materials and applications; Superconductors; Dielectric materials, their properties and applications. Smart materials: Sensors and actuators, piezoelectric, magnetostrictive and electrostrictive materials.

Diffusion and Corrosion: Diffusion in solids, Corrosion: their type, cause and protection against corrosion.

Materials Selection: Overview of properties of engineering materials, Material selection in design based on properties covering timber, aluminium, glass, polymers and ceramics.

Laboratory Work:

1. Determination of the elastic modulus and ultimate strength of a given fiber strand.
2. To measure grain size and study the effect of grain size on hardness of the given metallic specimens.
3. To determine fiber and void fraction of a glass fiber reinforced composite specimen.
4. To study cooling curve of a binary alloy.
5. Detection of flaws using ultrasonic flaw detector (UFD).
6. To determine the dielectric constant of a PCB laminate.
7. To estimate the Hall coefficient, carrier concentration and mobility in a semiconductor crystal.
8. To estimate the band-gap energy of a semiconductor using four probe technique.

Micro Project:
The micro-project will be assigned to the group(s) of students at the beginning of the semester. Based on the interest and branch of the student, he will carry out one of the followings:

1. Design experiments to determine various mechanical properties like strength, ductility, elastic modulus, etc. of a given specimen(s) and correlate them.
2. Design an experiment to classify the given specimens based on their electrical properties.
3. Identify the most suitable material from the given specimens for solar cell application.
4. Identify the suitability of given samples in marine, acidic and alkaline environment.
5. Design a virtual experiment to analyse / predict physical properties of a given material/composite.

Course Learning Outcomes (CLO):
Student will be able to:

1. understand structure-property correlation;
2. read phase diagrams and can predict the properties of the solid based on the phase diagram.
3. discriminate between materials based on their electrical and magnetic properties and should be able to describe temperature and field dependence of electrical and magnetic properties.
4. select materials based on their properties for a defined application.

Text Books:

1. *W.D. Callister, Materials Science and Engineering; John Wiley & Sons, Singapore, 2002.*
2. *W.F. Smith, Principles of Materials Science and Engineering: An Introduction; Tata Mc-Graw Hill, 2008.*
3. *V. Raghavan, Introduction to Materials Science and Engineering; PHI, Delhi, 2005.*

Reference Books:

1. *S. O. Kasap, Principles of Electronic Engineering Materials; Tata Mc-Graw Hill, 2007.*
2. *L. H. Van Vlack, Elements of Material Science and Engineering; Thomas Press, India, 1998.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional	40

UMA007: NUMERICAL ANALYSIS

L	T	P	Cr
3	1	2	4.5

Course Objective: The main objective of this course is to motivate the students to understand and learn various numerical techniques to solve mathematical problems representing various engineering, physical and real life problems.

Floating-Point Numbers: Floating-point representation, rounding, chopping, error analysis, -conditioning and stability.

Non-Linear Equations: Bisection, secant, fixed-point iteration, Newton method for simple and multiple roots, their convergence analysis and order of convergence.

Linear Systems and Eigen-Values: Gauss elimination method using pivoting strategies, LU decomposition, Gauss--Seidel and successive-over-relaxation (SOR) iteration methods and their convergence, ill and well-conditioned systems, Rayleigh's power method for eigen-values and eigen-vectors.

Interpolation and Approximations: Finite differences, Newton's forward and backward interpolation, Lagrange and Newton's divided difference interpolation formulas with error analysis, least square approximations.

Numerical Integration: Newton-Cotes quadrature formulae (Trapezoidal and Simpson's rules) and their error analysis, Gauss--Legendre quadrature formulae.

Differential Equations: Solution of initial value problems using Picard, Taylor series, Euler's and Runge- Kutta methods (up to fourth-order), system of first-order differential equations.

Laboratory Work: Lab experiments will be set in consonance with materials covered in the theory. Implementation of numerical techniques using MATLAB.

Course learning outcomes: Upon completion of this course, the students will be able to**:**

1) understand the errors, source of error and its effect on any numerical computations and also analysis the efficiency of any numerical algorithms.
2) learn how to obtain numerical solution of nonlinear equations using bisection, secant, Newton, and fixed-point iteration methods.
3) solve system of linear equations numerically using direct and iterative methods.
4) understand how to approximate the functions using interpolating polynomials.
5) learn how to solve definite integrals and initial value problems numerically.

Texts Books:

1) Curtis F. Gerald and Patrick O. Wheatley, Applied Numerical Analysis, Pearson, (2003) 7th Edition,
2) M. K. Jain, S .R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers (2012), 6th edition.

3) Steven C. Chappra, Numerical Methods for Engineers, McGraw-Hill Higher Education; 7 edition (1 March 2014)

References Books:

1) J. H. Mathew, Numerical Methods for Mathematics, Science and Engineering, Prentice Hall, (1992) 2nd edition,

2) Richard L. Burden and J. Douglas Faires, Numerical Analysis, Brooks Cole (2004), 8th edition.

3) K. Atkinson and W. Han, Elementary Numerical Analysis, John Willey & Sons (2004), 3rd Edition.

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	25
2.	EST	40
3.	Sessionals (May include assignments/quizzes)	15
4.	Laboratory Evaluation	20

SEMESTER-V

UCE401: HYDROLOGY AND GROUNDWATER

L	T	P	Cr
3	1	0	3.5

Course objective: The overall objective of this course is to acquaint students to the engineeringaspects of water science. The students will learn different pathways of water movement, estimation and analysis of various components of pathways and its applications in designing various water related projects.

Introduction: Hydrologic cycle, Scope and Applications.

Precipitation*:*Measurement by rain gauge and other methods, estimation of missing data,consistency of records, optimum number of rain gauge station, mean precipitation, presentation and analysis of rainfall data.

Abstractions from Precipitation: Factors affecting Evaporation measurement, infiltration, factorsaffecting Infiltration, measurement and presentation, Infiltration indices.

Run off: Run-off estimation, rainfall-runoff correlation, flow duration curve, flow mass curve,hydrographs, base flow separation, unit hydrographs and its application, distribution graph, synthetic unit hydrograph, Instantaneous unit hydrograph

Stream flow measurement: Velocity measurement: floats, velocity rods, current meters,discharge computation: velocity area method, moving boat method, dilution method, slope area method, stage discharge curve.

Floods Frequency analysis: Peak flood estimation, methods of frequency analysis, flood routing

Ground Water Hydraulics:Type of aquifers, aquifer constants, Darcy's law, Steady flowtowards fully penetrating well, Equation of motion and its applications to ground water flow problems, introduction to the use of distributed groundwater models.

Course learning outcome (CLO):

Upon completion of this course, the students will be able to:

1. Recognize various components of hydrologic cycle and evaluate water availability based on water budget equation
2. Perform analysis on precipitation, evaporation and infiltration data for various applications.
3. Estimate runoff generated from watershed based on empirical and hydrograph analysis.
4. Estimate discharge of rivers using various methods
5. Aply principles of flood frequency analysis and flood routing to forecast floods
6. Apply hydraulic principles of groundwater flow in different geological formations.

Text Books:

1. *Subramanya, K., Engineering Hydrology, Tata McGraw-Hill Publication(2015)*
2. *Reddy, Jaya Rami., A textbook of Hydrology, University Science Press, New Delhi (2014)*
3. *Raghunath, H. M., Hydrology: Principles, analysis and Design, New Age International Publishers(2015)*

Reference Books:

1. *Chow, V.T., Maidment, D.R., and Mays, L.W., Applied Hydrology, Mc-Graw-Hill International Editions, New York (2006)*
2. *Misstear, B., Banks, D., and Clark, L., Water Wells and Boreholes, John Wiley& Sons Ltd, UK(2013)*
3. *Shaw, E.M., Beven, K.J., Chappell, N.A., and Lamb, R. , Hydrology in Practice, Spon Press, New York(2014)*
4. *Viessman, W. and Lewis, G.L., Introduction to Hydrology, Prentice Hall of India Pvt Limited, New Delhi (2012)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE501: SOIL MECHANICS

L	T	P	Cr
3	1	2	4.5

Course Objectives: This subject aims to develop an understanding of soil as civil engineeringmaterial and to introduce the students about the basic concepts and principles of soil mechanics. Further they will be introduced to the concepts of compaction, consolidation and determination of shear strength of soil.

Introduction*:*Soil formation, various soil types.

Phase relationships:Index properties, sieve & hydrometer analysis, Atterberg's limits, sensitivity, thixotropy, and plasticity charts. Determination of engineering properties of soil. Indian standard and Unified classification systems of soils.

Clay Mineralogy: Introduction to Clay minerals their characteristics. Soil structure, granular soilfabric.

Seepage and Permeability:Darcy's law, validity of Darcy's Law, seepage velocity, factorsaffecting permeability, Laboratory and field determination of permeability. Flow net and its properties, Laplace equation, methods of drawing flow net, seepage through earth dams, exit gradient and seepage pressures, phenomenon of piping and heaving, filters. Anisotropy, Permeability of layered soils.

Effective Stress Principle: Capillarity, types of head, seepage forces, quick sand condition, andcritical hydraulic gradient.

Compaction: Compaction tests, OMC, factors affecting compaction, control of compaction,field compaction equipment and their suitability. Stresses in Soils:Stresses beneath various loaded areas, Boussinesq and Westergarrd's formulae, pressure bulbs, Newmark's chart. Approximate methods

Compressibility and Consolidation:Terzaghi's theory, time rate of consolidation,consolidation test, Compressibility & Coefficient of Consolidation, NC, OC soils, determination of pre-consolidation pressure, settlement analysis, secondary consolidation.

Shear Strength:Definition, Mohr's stress circle, Mohr-Coulomb strength theory, direct, triaxial,unconfined and vane shear tests. Drainage conditions, Concept of pore pressure coefficients, shear characteristics of normally consolidated, over consolidated clays and dense and loose sands, Dilatancy, residual strength, Introduction to stress path.

Laboratory Work:

The students will be introduced to Index and Engineering properties of soils to complement the theory component of the course by performing experiments. They will perform related experiments as per BIS specifications.

1. Determination of field density by Core cutter & Sand replacement method
2. Grain size Analysis by Mechanical& Hydrometer Method.
3. Determination of Specific Gravity by Pycnometer.
4. Determination of Liquid Limit, Plastic limit & Shrinkage limit.
5. Determination of Permeability by constant head & variable head permeameter.
6. Consolidation Test
7. Unconfined Compression Test.
8. Direct Shear Test.

Experimental Project/assignment/Micro Project: Students in groups of 4 to 6 will do the following projects:

1. Bringing soil samples from the field classify them by performing lab tests and then determining the optimum moisture content and maximum dry density.
2. Based on OMC and MDD they will prepare samples for determination of CBR.

Course learning Outcome (CLO):

Upon completion of this course, the students will be able to:

1. Determine the index and engineering properties of soil
2. Evaluate the influence of water on engineering properties of soil
3. Evaluate the compressibility characteristics of soils in engineering practices
4. Determine the shear strength of soils by various methods

Text Books:

1. *Gopal Ranjan& A.S.R. Rao, Basic and Applied Soil mechanics, New Age Publisher, New Delhi (2016)*
2. *V.N.S. Murthy, A text book on Soil Mechanics and Foundation Engineering, U.B.S. Publisher, New Delhi.(2005)*
3. *Parshotham Raj, Geotechnical Engg., Pearson , New Delhi.(2013)*

Reference Books:

1. *Das B.M., Principles of Soil Mechanics, Thomson Publisher, USA. (2015)*
2. *Venkatramaiah Geotechnical Engg., New Age Publisher, New Delhi. (2012)*
3. *Singh Alam Modern Geotechnical Engineering, CBS Publishers, New Delhi.(2014)*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UCE507: ADVANCED STRUCTURAL ANALYSIS

L	T	P	Cr
3	1	0	3.5

Course Objective: This course aims to develop an understanding of the two basic types ofApproaches of Systems and Element Approach for analyzing indeterminate structures.This is followed by an understanding of the analysis of cables in various structures and finally introduction to Finite Element Method applied to 1-D bar element.

Analysis of typical structures: Two hinged and three hinged arches, influence lines for thrust,radial shear and bending moment, Analysis of cables.

Introduction to system approach: Force and Displacement methods

Matrix Force Method: Introduction to flexibility approach, Choice of redundant, staticequilibrium matrix, deformation compatibility matrix, member flexibility matrix, static equilibrium and deformation compatibility checks. Application for trusses, continuous beams and rigid frames

Matrix Displacement or Stiffness Method: Introduction to displacement approach, calculation ofkinematic indeterminacy, development of stiffness matrices for continuous beams and rigid jointed frames, Development of matrix displacement approach and application to continuous beams and rigid frames

Transformation Matrices: Element Approach: Introduction to Element Approach, Developmentof force transformation matrices and system flexibility matrix using element approach, Development of transformation matrices and system stiffness matrix using element approach, Analysis of structures using element approach.

Experimental Project/assignment/Micro Project: Students in groups of 4 to 6 will developwork sheet for analyzing plane frame structure using either Stiffness/Flexibility Method and verify the same using standard analysis and design software (STAAD)

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Analyze two hinged and three hinged arches and cables
2. Develop stiffness matrices of different types of structures using System Approach and subsequently analyze the structures.
3. Develop system stiffness matrix using transformation matrices and subsequently analyze the structures using Element Approach.
4. Develop system flexibility matrices for different types of structures using System Approach and subsequently analyze the structures.
5. Develop system flexibility matrix using force transformation matrices and subsequently analyze the different structures using Element Approach.

Text Books:

1. *Gere J. M. and Weaver W.; Matrix Analysis of Framed Structures, CBS Publishers & Distributors(2012)*

2. *Pandit G. S. and Gupta S. P.; Structural Analysis – A Matrix Approach; Tata McGraw Hill Education Pvt. Ltd.(2001)*

Reference Books:

1. *Martin H. C.; Matrix Structural Analysis, McGraw Hill Book Company, New York.(1966)*

2. *PrakashRao D. S.; Structural Analysis – A Unified Approach, Tata McGraw Hill Publishing (2008)*

3. *Reddy C. S.; Basic Structural Analysis, Tata McGraw Hill Publishers.(2001)*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weights (%)**
1.	Mid Semester Test	30
2.	End Semester Test	45
3.	Sessionals (Includes Assignments/Projects/Quiz Evaluations)	(5 + 10+ 10) = 25

UCE506: CONSTRUCTION MANAGEMENT

L	T	P	Cr
3	1	0	3.5

Course Objective: This subject aims to develop an understanding of principles and techniques ofestimating construction costs, with emphasis on quantity take-off and pricing elements of work. It also covers the basic principles, techniques, and practices used as management tools by contractors to plan, schedule, and control time and costs on building various infrastructure projects.

Quantity Surveying and Cost Estimation: Definitions, objectives, role and functions of quantitysurveyor, Pre-tender survey, Quantity measurements, Bill of quantities, analysis of rates for different items of work. Specifications.General and detailed specifications for different items of work.Estimates and budgets types and their preparation. Estimate of Buildings, Roads, Building Bye Laws, Taking-off quantities, Methods of measurement, e-tendering, Bill of quantities.

Contracts: Definition, need, importance, types of contracts and their characteristics, procedure fortendering and contracts, evaluation and examination of tenders, award of work, Joint Ventures, Concession Agreements. Valuation, its types.Determination of value of a property, Calculation of standard rent.Definitions, functions, characteristics of project, planning and principles of Planning and Management.

Network Techniques: Bar milestone charts Planning and scheduling of PERT / CPM, Time costoptimization, Probability concepts Allocation of resources and resource levelling, Updating, controlling and monitoring, Work Breakdown Schedule (WBS).

Material& Equipment Management: Importance, scope, objectives and functions, identificationof source and vendor analysis, purchase, procurement procedure, inventory control, EOQ analysis. Importance, need, functions and principles of equipment management, types of equipment and their uses, selection planning and matching of construction plant and equipment.

Account Procedure of PWD Works: Classification of Works, Muster Roll, and Deposit works. Cash Book, Imprest, temporary Advance, Stores, Indent, Tools and Plants

Experimental Project/assignment/Micro Project:

1. Complete cost estimation of the building and highway projects including taking off and assemble bill of quantities.

2. Development of a contract document for the infrastructure project.
3. Planning &Scheduling of an infrastructure projects.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Perform the rate analysis for the various construction activities
2. Estimate the cost for the building and the road projects
3. Perform the project planning, scheduling, time-cost optimization, resource allocation and project controlling
4. Prepare the contract documents for a given project
5. Apply various material & equipment management techniques in a project
6. Assemble bill of quantities

Text Books:

1. *Kohli D. D.; A Text book on Estimating and Costing and Accounts, S. Chand & Company New Delhi(1994).*
2. *R.L. Peurifoy, W.B. Ledbetter and C.J. Schexnayder, "Construction planning and methods", Fifth editions, McGraw Hill International edition(1996).*

Reference Books:

1. *Seetharaman S., Construction Engineering and Management, Umesh Publication Delhi(2001).*
2. *Punima B. C. and Khandelwal; Project Planning and Control with PERT and CPM,Laxmi Publication New Delhi(2002).*
3. *K.K. Chitkara, Construction project management: planning, scheduling and controlling, Tata McGraw-Hill (1998).*
4. *B. Sengupta and H Guha, "Construction management and planning", Tata McGraw Hill(1995).*
5. *L.S. Srinath, PERT and CPM principles and Application, Third edition, Affiliated east-west press Pvt Ltd(2001)*
6. *J. Singh, Heavy Construction-Planning, equipment and method, Oxford & IBH Publishing Co. Pvt(1993)*
7. *Datta B. N. Estimating and Costing in Civil Engineering, U.B.S. Publisher(2010)*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	30
2.	EST	40
3.	Sessional (include Assignments/Projects/Tutorials/Quizzes)	30

UCE509: TRANSPORTATION ENGINEERING – I

L	T	P	Cr
3	0	2	4

Course Objective: The objective of the course is to enable students study different types ofpavements, to analyze road pavement structures, to differentiate between the different types of materials used and to design and construct road pavements. Another objective is to expose the students to geometric design, both vertical and horizontal and to enable the civil engineering students to study the road user characteristics and formulate fundamental principles of traffic flow, traffic characteristic measurements.

General: Different modes of transport, Development of Transport System, Phased development ofRoads in India.

Planning of Highways: Planning & Management of Highways, Various road plans developed inIndia, Road patterns, Highway Surveys & Alignment, Design, Drawings, Estimates & Project Report.

Geometric Design of Highways: Introduction, Highways Classification, Right of way, Landwidth, width of formation, Thickness of pavement, Sight Distances, Stopping site distance, overtaking sight distance, overtaking zones, camber, Road Curves, Transition Curves, Super elevation. Widening at curves, IRC-recommendations for various geometric design parameters.

Construction of Roads: Various types of bituminous constructions and their selection,Construction of earth, gravel, water bound macadam, surface dressing, premixed carpet, bituminous macadam, bituminous concrete, mastic asphalt, cement concrete pavements.

Types of bituminous binders and properties: Manufacturing of bitumen, Paving bitumenspecifications as per IS 73: 2013, comparison between bitumen, tar, cut back & emulsion, Modified binders and its rheology.

Pavements: Factors affecting design of pavements. Structure of Flexible pavement and its designprocedure as per IRC 37:2001, 2012 and IRC72: 2007, Construction of Cement Concrete Roads & its layer specifications, Design of PQC pavements as per IRC 58 & SP 062.

Failures of flexible and rigid pavements: Causes of Failures and Remedial Measures,Maintenance of flexible and rigid pavements, pavement evaluation and its strengthening.

Traffic Studies: Definition of Traffic Engineering, Various faces of Traffic Engineering, Roaduser characteristics, Importance of traffic studies, spot speed, speed and delay and origin and destination studies. Traffic accident studies, Causes of accidents and Remedial Measures, Parking studies.

Drainage: Introduction, Importance & Principles of Highway Drainage, Surface Drainage, SubSurface drainage.

Highway Maintenance: Introduction, Maintenance of Earth, gravel, WBM Roads, BituminousRoads, Cement Concrete pavements.

Highway Economics: Economics of Pavement types, Economic Evaluation of Highway Schemes,Life Cycle Costing.

Laboratory Work: The students will perform various quality control tests as per Indian RoadCongress (IRC) & Ministry of Road Transport & Highways (MORTH) specifications for the various layers of the pavement section. Paving bitumen & bituminous mix testing like penetration value, softening point, viscosity & binder rheology, ductility value, centrifugal extraction, aggregate strength tests, pavement layer gradation & stability - flow analysis, Deflection studies for the granular layers of the flexible & rigid pavements.

Experimental Project/assignment/Micro Project: Students in groups of 4 to 6 will do theprojects:

1. Calculate the un-soaked and soaked CBR value of different soil samples.
2. Design the flexible pavement as per IRC 37:2012 for the given traffic data.
3. Design the rigid pavements as per the IRC guidelines.

Course learning Outcome (CLO):

Upon completion of this course, the students will be able to:

1. Quantify the specifications of various road construction materials required
2. Perform geometric design of highways and expressways
3. Perform analysis and design of flexible and rigid pavements
4. Address highway maintenance, drainage and economic issues
5. Perform the traffic studies necessary before making changes to or designing new road Infrastructure

Text Books:

1. *Khanna S.K. and C.E.G. Justo,HighwayEngineerin, Nemchand Bros(2012).*
2. *Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee (2004).*

Reference Books:

1. *Sharma & Sharma; Principle and Practice of Highway Engineering, Asia Publishing House, New Delhi (2010).*
2. *Rao G. V.; Transportation Engineering, Tata McGraw Hill Publisher, New Delhi (1999).*
3. *Yoder E. J.; Principles of Pavement Design, John Wiley & Sons (1975).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UCE592: SURVEY PROJECT

L	T	P	Cr
-	-	-	4

Course Objective: To expose student to the various surveying tools and techniques in the field.The students, after completing their second year, are supposed to go on a survey camp, which shall be held over a period of three to four weeks, either at the university or at some site outside. As a part of this they have to prepare a topographical sheet of the area highlighting the main features including contouring etc.

Course Learning Outcome (CLO):

Upon completion of this course, the students will be able to:

1. Perform basic surveying on a considerably difficult hilly terrain
2. Set up traverse stations, base-line measurements, fly leveling, detailing, and contouring

UCE609: DESIGN OF STEEL STRUCTURES-I

L	T	P	Cr
3	1	0	3.5

Course Objectives: This subject aims to develop an understanding of the design of steel sectionswhen subjected to various kinds of external loads. The basic structural members like tension member, compression member and beams along with their connection will be designed.

Introduction: Loads, structural steels and their specifications, structural elements, steel vs.concrete and timber, design specifications as per IS: 800, structural layout, strength and stiffness considerations, efficiency of cross-section, safety and serviceability considerations.IS2062-2011

Riveted/Bolted Connection: Riveting and bolting, their types, failure of riveted joint, efficiencyof a joint, design of riveted joint, concentric riveted joints, advantages and disadvantages of bolted connections, stresses in bolts.

Welded Connection: Types of welded joints, design of welded joint subjected to axial loads,welded joints subjected to eccentric loads, simple, semi-rigid and rigid connections.

Tension Members: Types of tension members, net area, net effective area for angles, tees, designof tension members, tension splice, and lug angles.

Compression Members: Axially loaded columns, effective length, slenderness ratio, allowablestresses, general specifications, design of axially loaded members, laced and battened columns and their design, built up compression members, eccentrically loaded columns and their design, column splice and its design, encased columns.

Column Bases: Introduction, slab base, gusseted base, column base subjected to moment, grillagefoundation.

Flexural Members (Beams): Design criteria, permissible stresses, laterally supported beams andtheir design laterally unsupported beams and their design, web buckling, web crippling, built up beams, encased beams, members subjected to bending and compression.

Plastic Design: Introduction, advantages and disadvantages, strength of tension and compressionmembers, theory of plastic bending, plastic hinge mechanism, collapse load analysis, static and mechanism method, distributed loading, design consideration.

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Design tension members
2. Design the bolted and welded connections between various structural components
3. Design compression members and column bases with and without eccentric loading
4. Find out ultimate load of the structural systems using plastic analysis
5. Design flexural members

Text Books:

1. *Subramanya, N, Design of Steel Structures, N. Subramanian, Oxford University Press(2008).*
2. *Duggal, S.K. Limit State Design of Steel structures, McGraw Hill (2009.)*

Reference Books:

1. *Ajmani, A. L. and Arya, A. S., Design of Steel Structures, Nem Chand and Brothers (2000).*
2. *Dunham, C.W., Planning of Industrial Structures, John Wiley and Sons (2001).*
3. *Gary, W., Steel Designer's Manual, Prentice Hall (2008).*
4. *Glover, F., Structural Pre-cast Concrete, Oxford Publishers (1963..)*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE692: GROUP DESIGN PROJECT (START)

L	T	P	Cr
0	0	0	2

Course Objectives: The main objective of the project is to gain hands-on experience in tacklingthe planning, analysis and design issues in open-ended structural design projects while performing the analysis and design of representative structural system and components. This project work covers various aspects including planning, architectural design, geotechnical constraints, structural analysis and design and construction planning & scheduling.

During the project, various experts from industry/academics/public body are invited to deliver talks on relevant issues like:-

1. Planning & preparation of architectural drawings of the building.
2. Design of building frames: Load pattern, design of continuous beams/slabs and detailing of various structural components as per the relevant Indian codal guidelines.
3. Preparation of detailed structural drawings.
4. Design of various allied services for the building project.
5. Preparation of general & special conditions of the contract for the project including specifications of the building based upon utility & functional aspects.
6. Preparation of the detailed cost estimation for the project.

The final project report should include the following

1. Description of the General Design Problem, Constraints, Functions, Design Life, and Other Relevant Considerations.
2. Design Assumptions, Analysis Methodologies Employed, and a Flowchart of the Design Process
3. Specific Design Considerations and Architectural Considerations
4. Design Details Including:
    a. Load Types, Loads, and Load Cases, Analysis and Design Computations, Deformed Shapes
5. Member Dimensions and Reinforcement Details.
6. Written and Illustrated Descriptions of the Architectural, Structural Designs including the services and bill of quantities.
7. Conclusion

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Function as a member of the design team.
2. Develop the general arrangement drawings.
3. Produce detailed structural design & drawings and viable construction sequence.
4. Produce a bill of quantities and calculate approximate construction cost.

Reference Books:

1. *Varghese, P. C., Limit State Design of Reinforced Concrete, PHI Publishers(2000)*
2. *Jain, A.K., Reinforced Concrete-Limit State Design, Nem Chand & Bros (2014)*
3. *Pillai & Menon, Reinforced Concrete Design, Tata McGraw Hill Publishers(2014)*

Evaluation Scheme:

Activity	Submission time line	Weightage
Problem Formulation & Design Flow Chart	End of week 4th of fifth semester	5%
Midway report-1	End of fifth semester (Before the start of EST of 5th Semester)	20%
Midway report-2	Before the start of MST of 6th Semester	30%
Final Assessment & Final Report & Presentation	End of Sixth semester	45% (Report = 20%) (Presentation & Viva Voce = 25%)

UTA012: INNOVATION AND ENTREPRENEURSHIP

L	T	P	Cr
1	0	2	4.5

(5 Self effort hours)

Course Objectives: This course aims to provide the students with a basic understanding in the field of entrepreneurship, entrepreneurial perspectives, concepts and frameworks useful for analysing entrepreneurial opportunities, understanding eco-system stakeholders and comprehending entrepreneurial decision making. It also intends to build competence with respect business model canvas and build understanding with respect to the domain of startup venture finance.

Introduction to Entrepreneurship: Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioural; entrepreneurial challenges.

Entrepreneurial Opportunities: Opportunities - discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering.

Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem , Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches**,** - Effectuation and Causation.

Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions - conventional industry logic, value innovation logic; customer focused innovation; building and analysing business models; Business model canvas , Introduction to lean startups, BusinessPitching.

Organizing Business and Entrepreneurial Finance: Forms of business organizations; organizational structures; Evolution of organization, sources and selection of venture finance options and its managerial implications.Policy Initiatives and focus; role of institutions in promoting entrepreneurship.

Course learning outcome (CLO):

Upon successful completion of the course, the students should be able to:

1. Comprehend the role of bounded rationality, framing, causation and effectuation in entrepreneurial decision making.
2. Demonstrate an ability to design a business model canvas.
3. Evaluate the various sources of raising finance for startup ventures.
4. Understand the fundamentals of developing and presenting business pitching to potential investors.

Text Books:

1. *Ries, Eric(2011), The lean Start-up: How constant innovation creates radically successful businesses, Penguin Books Limited.*
2. *Blank, Steve (2013), The Startup Owner's Manual: The Step by Step Guide for Building a Great Company, K&S Ranch.*

3. *Osterwalder, Alex and Pigneur, Yves (2010) Business Model Generation.*
4. *T. H. Byers, R. C. Dorf, A. Nelson, Technology Ventures: From Idea to Enterprise, McGraw Hill (2013)*

Reference Books:

1. *Kachru, Upendra, India Land of a Billion Entrepreneurs, Pearson*
2. *Bagchi, Subroto, (2008), Go Kiss the World: Life Lessons For the Young Professional, Portfolio Penguin*
3. *Bagchi, Subroto, (2012). MBA At 16: A Teenager's Guide to Business, Penguin Books*
4. *Bansal, Rashmi, Stay Hungry Stay Foolish, CIIE, IIM Ahmedabad*
5. *Bansal, Rashmi, (2013). Follow Every Rainbow, Westland.*
6. *Mitra, Sramana (2008), Entrepreneur Journeys (Volume 1), Booksurge Publishing*
7. *Abrams, R. (2006). Six-week Start-up, Prentice-Hall of India.*
8. *Verstraete, T. and Laffitte, E.J. (2011). A Business Model of Entrepreneurship, Edward Elgar Publishing.*
9. *Johnson, Steven (2011). Where Good Ideas comes from, Penguin Books Limited.*
10. *Gabor, Michael E. (2013), Awakening the Entrepreneur Within, Primento.*
11. *Guillebeau, Chris (2012), The $100 startup: Fire your Boss, Do what you love and work better to live more, Pan Macmillan*
12. *Kelley, Tom (2011),The ten faces of innovation, Currency Doubleday*
13. *Prasad, Rohit (2013), Start-up sutra: what the angels won't tell you about business and life, Hachette India.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	20
2	EST	40
3	Sessionals(Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

SEMESTER-VI

UCE603: HYDRAULIC ENGINEERING

L	T	P	Cr
3	1	2	4.5

Course Objectives: This course aims to develop an understanding of the model studies ofhydraulic structures and design of open channel sections under different situations. Further, this course aims to expose the students to various aspects of applications of laminar flow, turbulent flow, boundary layer formation and drag and lift to real flow situations.

Dimensional Analysis: Methods and model studies.

Flow in open channels: Continuity equation, analysis of uniform flow, most economical channelsections, specific energy, specific force, applications to channel transitions, analysis of non-uniform flow, water surface profiles, hydraulic jump, surges, pressure transients.

Discharge Measurement: Notches, weirs, venturiflume, standing wave flume, freeoverfall.

Flow in pipes: Navier-Stokes equations for laminar flow, laminar flow through pipe and parallelplates, laminar flow past a sphere, shear stress in turbulent flow, velocity distribution equations for turbulent flow in pipes, Resistance of smooth, rough and commercial pipes, Reynolds equations of turbulence, pipe network analysis, water distribution system.

Boundary layer and flow around submerged bodies: Boundary layer characteristics, Von-Karman momentum integral equation and its applications to velocity profiles, drag and lift on submerged bodies, development of lift on a cylinder and airfoil.

Pumps and Turbine: Introduction to various types of pumps and turbines

Laboratory Work: Students will perform following basic experiments in Hydraulic Engineering

1. To determine the viscosity of liquid and to verify stokes Law
2. To determine Manning's coefficient of roughness for the bed of a given flume.
3. To measure the velocity distribution in a rectangular flume and to determine the energy and momentum correction factors.
4. To study the flow characteristics through a rectangular open channel transition.
5. To study the formation of hydraulic jump in a horizontal rectangular open channel.
6. To measure velocity distribution over a flat surface in a wind stream and to determine the displacement and momentum thickness.
7. To measure the pressure distribution around a cylinder/airfoil placed in a wind stream and to calculate the coefficient of drag.
8. To study the pressure distribution along the spillway surface.

Experimental Project/Assignment/Micro Project: Students in groups of 4 to 6 will do projectson weirs, velocity distribution using Pitot tube and micro current meter in channels of different shapes, free overfall, drag and lift on various body shapes, design water distribution system using EPANET software.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Analyze the significant variables in hydraulic problems and to predict the performance of hydraulic prototypes
2. Design the most economical channel sections and to use the specific energy and specific force concepts in channel transitions
3. Analyze the water surface profiles under different flow situations
4. Develop head discharge relationship for discharge measuring hydraulic structures
5. Employ the concepts of laminar, turbulent flow and boundary layer formation in real flow situations
6. Design water distribution networks

Text Books:

1. *Modi and Seth, Fluid Mechanics and Fluid Machines, Standard Book House, New Delhi.(2010)*
2. *Subramanya K., Flow in open Channels, Tata McGraw Hill, New Delhi.(2008)*
3. *French R. H, Open Channel Hydraulics, McGraw Hill Publishing Company, New York.(2007)*

Reference Books:

1. *Som and Biswas, Introduction to Fluid Mechanics and Machines, Tata McGraw Hill, New Delhi (2012)*
2. *Rangaraju K. G., Flow through Open Channels, Tata McGraw Hill, New Delhi (2008)*
3. *Schlichting H., Boundary Layer Theory, Tata McGraw Hill, New Delhi (2008)*
4. *Henderson F. M: Open Channel Flow, McMillan, New York (2007)*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UCE605: TRANSPORTATION ENGINEERING – II

L	T	P	Cr
3	1	0	3.5

Course Objective: This subject aims to develop an understanding of the basics and design ofvarious components of railway engineering as per the Indian railway guidelines. Further to this, subject also aims at introducing the detail concepts of the airport engineering and to give the students the confidence of delivering a complete geometric and structural design of runway, taxiway and apron pavements.

Railway Engineering: Permanent way, gauges in railway tracks, typical railway track cross-section, coning of wheels, Function of rails, requirement of rails, types of rail sections – comparison of rail types, length of rail, rail wear, rail failures, creep of rails, rail fixtures and fastenings – Fish plates, spikes, bolts, chairs, keys, bearing plates.

Sleepers: Functions and requirements of sleepers, classification of sleepers, timber, metal andconcrete sleeper, comparison of different types of sleepers, spacing of sleepers and sleeper density.

Ballast: Function and requirements of ballast, types, comparison of ballast materials. Geometric design: alignment, horizontal curves, super elevation, equilibrium, cant and cant deficiency, length of transition curve, gradients and grade compensation. Stations and yards, and their classification

Points and crossings: introduction, necessity of points and crossings, turnouts, points andcrossings, design of a simple turnout.

Track Recording: Equipment, Mechanized Maintenance, High Speed Trans, Present & Future.Signaling and interlocking: objects of signaling, engineering principle of signaling, classification of signaling, control of train movements, interlocking definition, necessity and function of interlocking, methods of interlocking, mechanical devices for inter locking. Traction and tractive resistance, stresses in track, modernization of railway track.

Airport Engineering: Airport site selection, various surveys for site selection. Classifications ofobstructions, Imaginary surfaces, Approach zone and turning zone.Runway orientation, basic runway length, corrections for elevation, temperature & gradient, airport classification.

Runway & Taxiway Design: Geometric design of runway, airport capacity, factors controllingtaxiway layout, geometric design standards for taxiway holding aprons, Wind-rose diagram, Structural design of runway pavements LCN/PCN method of rigid pavement design, Pavement Evaluation for runway & taxiway, design of overlay, Terminal area, building area, parking area, apron, hanger typical airport layouts. Design of flexible and rigid runways as per FAA procedure, Specifications for the different layers of runway and taxiway pavements, Pavement management systems for runway pavements.

Experimental Project/assignment/Micro Project

1. To design the flexible & rigid runway & apron pavements.
2. To design the turnout as per the Indian Railway specifications.
3. To perform the data analysis for developing management systems for airport pavements.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Determine the runway orientation and the runway length as per FAA &ICAO guidelines.
2. Design the airport pavements including air-side marking & lighting as per ICAO & FAA guidelines
2. Evaluate pavement and learn the concept of pavement maintenance management system.
3. Employ Railway Track specifications and perform geometric design of the railway track.
4. Design turnout and crossings as per the Indian Railways

Text Books

1. *Arora and Saxena, Railway Engineering, Dhanpat Rai & Sons, New Delhi (2006).*
2. *Khanna, Arora & Jain, Airport Planning and Design, Nem Chand & Brothers, Roorkee (1999).*

Reference Books

1. *Rangawala, Railway Engineering, Charotar Publishing House, Anan (1989).*
2. *Aggarwal M.M., and Satish Chandra Railway Engineering, Oxford University Press (2002).*
3. *Horenjeff Robert, Airport Engineering, McGraw Hill International Publisher (2010).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	40
3	Sessional (include Assignments/Projects/Tutorials/Quizzes)	30

UCE606: WATER AND WASTE WATER ENGINEERING

L	T	P	Cr
3	1	2	4.5

Course Objective: To introduce the water supply and sanitation systems, designing thecomponents associated with the water supply and sanitation systems, and suitable treatment processes for both water supply and wastewater.

Water and water supply system: Water quality, source of surface water pollution, waterquality standards; Water demand, components of water supply system; water intake works; Water transmission systems

Water treatment*:*Water treatment plants and components; Technologies for the removal ofsuspended, colloidal and dissolved solids and for disinfection; Design of coagulation-flocculation-settling, slow sand and rapid gravity filtration, membrane filtration, ion exchange, adsorption and chlorination units.

Wastewater system: Quantification of sewage; Characterization of sewage; Types ofsewerage systems; Design of sewers and storm sewers, sewer outfalls and sewer appurtenances

Wastewater treatment: Components; Design of screens, degritters, clarifiers and roughingfilters; Activated Sludge, UASB and modified UASB reactors, and Waste stabilization pond systems, vegetated ponds and constructed wetland systems; Sewage treatment plant sludge handling facilities.

Laboratory work:

pH, acidity, alkalinity and hardness testing; DO, BOD and COD; Solids (TSS, VSS and TDS); Nutrients (TKN, TN and TP); SVI and Settling tests; Chlorination, residual chlorine and MPN test; Oil and grease and pesticides; Iron, fluorides, sulfates, chlorides, sulfides and phenols

Experimental Project/assignment/Micro Project: Students in groups of 4 to 6 will do theprojects on:

1. Design of Sewerage systems
2. Design of Water treatment plants/Sewage treatment plants

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Characterize water and wastewater
2. Design a water supply system/sewerage system
3. Conceive and design a water treatment plant
4. Conceive and design a sewage treatment plant

Text Books:

1. *Garg, S.K ,Environmental Engineering, Vol. I,.Khanna Publishers, New-Delhi.(1990)*
2. *Manual on Water Supply and Treatment by Ministry of Urban Development, New Delhi (1999.)*
3. *Manual on sewerage and sewage treatment, Ministry of Urban Development, New Delhi (1995)*
4. *P.N. Modi; Sewage Treatment and disposal & Waste Water Engineering, Standard Book House New-Delhi (1995)*

References Books:

1. *Met Calf & Eddy Wastewater Engineering, McGraw Hill (2003).*
2. *Peavy, Rowe and Tchobanglous, Environmental Engineering, McGraw Hill (1993).*
3. *Fair, Geyer &Okun, Water and Waste Water Engineering (Vol. 1&2), John Wiley, New York(1967).*
4. *Sawyer, McCarty &Parkins, Environmental Chemistry, McGraw Hill (2003).*
5. *Standard Methods for the Examination of Water and Waste Water, American Public Health Association (2014).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizs/Lab Evaluation)	40

UCE607: FOUNDATION ENGINEERING

L	T	P	Cr
3	1	2	4.5

Course Objective: This subject aims to expose the students to geotechnical design of differenttypes of shallow and deep foundations. Further they will be expose to understanding of earth pressure for stability of retaining structures along with various techniques for stability of slopes.

Soil Exploration: Introduction to soil exploration, scope, soil exploration for different structures,spacing, significant depth, boring and sampling techniques, bore hole plan, types of samples, penetration test (SCP and SPT), sample disturbances and Geophysical methods.

Earth Pressure: At rest condition, states of plastic equilibrium, Rankine and Coulomb's theoriesfor active and passive conditions, Influence of surcharge, water table, wall friction, open cuts.

Stability of Slopes:Infinite slope, types of failure, total and effective stress analysis, Taylor'sstability numbers, concept of factors of safety, method of slices, modified method of slices, Swedish's circle method, friction circle method, effect of sudden draw down and submergence.

Bearing Capacity: Definitions, introduction to shallow and deep foundation, depth of foundation,Concept of net and gross bearing capacity.Terzaghi's general bearing capacity equation, IS code equation, factors affecting bearing capacity. Settlements for clays and sands, permissible settlements, bearing capacity by penetration tests, Influence of eccentric and inclined loads, proportioning of footings, plate load test.

Pile Foundations: Types, function, selection of piles, pile driving formulae, equipment, point,bearing and friction piles. Load carrying capacity of single pile, group action, spacing of piles, Negative skin friction, settlement of pile groups, under-reamed piles.

Caissons and Wells: Introduction, components, shapes, stability of well foundation, Terzaghi'smethod of analysis, sinking of well, tilts and shifts.

Machine Foundation: Definition, types, problem of machine foundation, soil spring constants.

Laboratory Work:

The students will be introduced to various laboratory & field experiments as per BIS specifications.

1. Determination of Relative density of coarse grained soils in dry and saturated conditions.
2. Determination of shear strength at different densities by Direct shear test.
3. Determination of MDD and OMC at different compactive effort by compaction test.
4. Determination of Unconfined compressive strength at different compactive efforts.
5. Determination of compressibility characteristics of fine grained soils by Consolidation test.
6. Determination of bearing capacity by Standard Penetration test.

7. Determination of shear strength of sands by Tri-axial shear test.
8. Determination of bearing capacity by Plate load test.
9. Determination of bearing capacity by static and dynamic cone Penetration test.
10. Determination of bearing capacity by lab and field vane shear test.

Experimental Project/assignment/Micro Project: Students in groups of 4 to 6 will do theprojects by conducting test like SPT , PLT and lab tests, the students will determine the safe bearing capacity for various structures like Multistoried buildings, OHSR etc.

Course learning Outcome:

Upon completion of this course, the students will be able to:

1. Design and analyze problems related to shallow and machine foundations
2. Analyze lateral earth pressure for design of earth retaining structures
3. Assess stability of natural/man-made slopes under varying in-situ material properties
4. Design and analyze problems related to pile and well foundations

Text Books:

1. *GopalRanjan& A.S.R. Rao, Basic and Applied Soil mechanics, New Age Publisher, New Delhi (2008).*
2. *Murthy V.N.S., Advanced Foundation Engineering, C.B.S. Publisher, New Delhi (2009).*
3. *Parshotham Raj, Geotechnical Engg., Pearson , New Delhi (2009).*

Reference Books:

1. *Bowles J.E., Foundation Analysis and Design, McGraw Hill Book Company, New York (2009).*
2. *Arora K.R., Soil Mechanics & Foundation Engineering, by, Standard Publishers, New Delhi (2010).*
3. *Saran Swami, Soil Dynamics and Machine Foundations, Galgotia Publishers, New Delhi (2008).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UCE608: DESIGN OF CONCRETE STRUCTURES II

L	T/D	P	Cr
2	1	0	2.5

Course Objective: The subject aims to develop an understanding of design and detailing ofdomes, beams curved in plan, various types of combined footings. Subject also covers the design concepts of water retaining and earth retaining structures.

Domes: Analysis and design of spherical and conical domes

Beams curved in plan: Reinforced Concrete Design Circular beam loaded uniformly andsupported on symmetrically placed columns.

Water Tanks: Introduction, general design requirements on no crack basis, Design of circular andrectangular tanks resting on ground, Design philosophy for design of overhead tanks, intze type tanks and their staging and foundation

Combined Footings: Different types, design of rectangular, trapezoidal, strap and raft footings,Pile Foundations.

Retaining Walls: Types, behavior, stability requirements, design of cantilever type retainingwalls. Introduction to design of counterfort retaining wall.

Experimental Project/assignment/Micro Project:

Students will be required to design and prepare structural drawing for Intze type watertank.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Analyze and design R.C.C. domes and beams curved in plan.
2. Design RCC water tanks
3. Design various types of combined footings
4. Design cantilever type retaining walls

Text Books:

Jain, A.K., Reinforced Concrete-Limit State Design, Nem Chand & Bros (1999).

Reference Books:

Varghese, P. C., Limit State Design of Reinforced Concrete, PHI Publishers (2002).

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	40
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	30

UCE692: GROUP DESIGN PROJECT

L	T/D	P	Cr
1	0	2	5

Course Objectives: The main objective of the project is to gain hands-on experience in tacklingthe planning, analysis and design issues in open-ended structural design projects while performing the analysis and design of representative structural system and components. This project work covers various aspects including planning, architectural design, geotechnical constraints, structural analysis and design and construction planning & scheduling.

During the project, various experts from industry/academics/public body are invited to deliver talks on relevant issues like:-

1. Planning & preparation of architectural drawings of the building.
2. Design of building frames: Load pattern, design of continuous beams/slabs and detailing of various structural components as per the relevant Indian codal guidelines.
3. Preparation of detailed structural drawings.
4. Design of various allied services for the building project.
5. Preparation of general & special conditions of the contract for the project including specifications of the building based upon utility & functional aspects.
6. Preparation of the detailed cost estimation for the project.

The final project report should include the following

1. Description of the General Design Problem, Constraints, Functions, Design Life, and Other Relevant Considerations.
2. Design Assumptions, Analysis Methodologies Employed, and a Flowchart of the Design Process
3. Specific Design Considerations and Architectural Considerations
4. Design Details Including:
    - Load Types, Loads, and Load Cases, Analysis and Design Computations of Deformed Shapes, Member Dimensions and Reinforcement Details.
5. Written and Illustrated Descriptions of the Architectural, Structural Designs including the services and bill of quantities.
6. Conclusions

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Function as a member of the design team.
2. Develop the general arrangement drawings.
3. Produce detailed structural design & drawings and viable construction sequence.
4. Produce a bill of quantities and calculate approximate construction cost.

Reference Books:

1. *Varghese, P. C., Limit State Design of Reinforced Concrete, PHI Publishers(2000)*
2. *Jain, A.K., Reinforced Concrete-Limit State Design, Nem Chand & Bros (2014)*
3. *Pillai&Menon, Reinforced Concrete Design, Tata McGraw Hill Publishers(2014)*

Evaluation Scheme:

Activity	Submission time line	Weightage
Problem Formulation & Design Flow Chart	End of week 4th of fifth semester	5%
Midway report-1	End of fifth semester (Before the start of EST of 5th Semester)	20%
Midway report-2	Before the start of MST of 6th Semester	30%
Final Assessment & Final Report & Presentation	End of Sixth semester	45% (Report = 20%) (Presentation & Viva Voce = 25%)

SEMESTER-VII

UCE794: PROJECT SEMESTER

L	T	P	Cr
0	0	0	20

Course Objective: The objective of the six month industrial training is to expose the final yearcivil engineering students to the competency, knowledge and skills needed to succeed at the workplace. By undergoing industrial training, they will be able to relate the theory that they learnt and applied them practically. Industrial Training is essential for students to develop the practical skills that they will need to be effective professional engineers.

Course Introduction: The project semester is aimed at developing the undergraduate educationprogramme in engineering to include a practical training in a professional engineering setting (a company, top educational institution, research institute etc.) hereafter referred to as host "organization" as deemed appropriate. The participating organizations are selected that are either already visiting Thapar University for placement or are forming new relationships of mutual benefit. The project semester gives the student the opportunity to translate engineering theory into practice in a professional engineering environment. A central requirement of the project semester is that it must be based around significant engineering work and is principally assessed on that basis. The technical activity should be related to both the student's engineering studies and to the host organization's activities, and it should constitute a significant body of engineering work at the appropriate level. It should involve tasks and methods that are more appropriately completed in a professional engineering environment and should, where possible, make use of human and technology resources provided by the organization. It consolidates the student's prior learning and provides a context for later research studies. The student remains a full time registered student at Thapar University during the project semester and this activity is therefore wholly distinct from any industrial interactions which may occur over vacation periods.

Course learning Outcomes:

The project work undertaken as part of the project semester is diverse. As a result, the Learning Outcomes will vary, but on completion of the module, students will have achieved several learning outcomes from the following list:

1. Able to identify and use appropriate mathematical methods, numerical techniques and software tools for application to new and ill-defined engineering problems;
2. Be able to integrate knowledge, handle complexity and formulate judgements with incomplete or limited information;
3. Have the ability to redesign products, processes or systems in order to improve productivity, quality, safety and other desired needs;
4. Have the ability to apply design methods, processes and techniques to unfamiliar, ill-defined problems, involving other disciplines;
5. Be able to design according to codes of practice and industry standards; to identify limitations of codes of practice and the need for their application

6. Have the ability to investigate and define a need and identify constraints including health, safety and legal issues and the impact of engineering solutions in a societal and environmental context;

7. Be able to make engineering judgements that take cognisance of the social, environmental, ethical, economic, financial, institutional and commercial considerations affecting the exercise of their engineering discipline;
8. Have the ability to consult and work with experts in various fields in the realisation of a product or system;
9. Have knowledge and understanding of concepts from a range of areas outside engineering;
10. Be able, via knowledge and understanding of group dynamics, to exercise leadership;
11. Be able to select and apply appropriate communication tools and write technical papers and reports;
12. Be able to describe the relevant advantages and disadvantages of various technologies to an audience, and to communicate effectively in public.

Evaluation Scheme:

Each student is assigned a faculty supervisor who is responsible for managing and assessment of the project semester. This includes a Reflective Diary which is updated throughout the project semester, an Interim Project Report, a Final Report with Learning Agreement/Outcomes and a Final Presentation & Viva which involves the faculty Supervisor and some other members from the department. A hard copy and electronic copy of all reports are required. The mentor from the host organization will be asked to provide his assessment on the designated form. A suggested weighting for the assessments is as follows:

Activity	**Submission time line**	**Marks awarded by**	**Weighting**
Reflective Diary	End of Project Semester	Faculty Supervisor	10%
Goals Report	End of week 4 of project semester	Faculty Supervisor	5%
Midway report	End of week 10 of project semester	Faculty Supervisor	15%
Final Assessment	End of project semester	Host Mentor	20%
Final Report	End of project semester	Committee assessment	20%
Oralandposter presentation and viva	End of project semester		30%

UCE701: GROUND IMPROVEMENT

L	T	P	Cr
3	1	0	3.5

Course Objective: To expose the students to various ground improvement techniques that can beused to enhance the engineering properties of soil mass.

Introduction: Necessity and importance of ground improvement, classification of groundimprovement methods and their suitability, Emerging trends in ground Improvement

Modification by admixtures: Premixing, Cement stabilization and cement columns, Limestabilization and lime columns.Stabilization using bitumen and emulsions, Stabilization using industrial wastes, Proportioning of aggregates - Triangular chart method and Rothfuch's method.

Mechanical stabilization: Shallow and deep compaction methods, compaction piles, vibro-compaction and vibro-replacement, stone columns, dynamic compaction

Hydraulic and electrical modification: Ground Improvement by drainage, De-watering methods.Design of dewatering systems, Preloading, Vertical drains, vacuum consolidation, Electro-kinetic dewatering, design and construction methods.Electro-osmosis and Electrochemical stabilization.

Thermal modification: Ground freezing methods, Hydrogeology of frozen soils, Strength andbehaviour of frozen soils. Ground heating methods and its effect on soil properties.

In-situ soil treatment: Grouts, properties, penetration, clay, cement clay, cement, clay-chemical,chemical and Bituminous grouts, grouting methods viz penetration, claquage, compaction & jet.

Reinforcement techniques: Introduction, load transfer mechanism, strength development,anchored earth, soil nailing, micropiles, soil dowels and anchors, reinforced earth.

Exclusion techniques: Sheet piles, contiguous bored piles, secant piles, slurry trenches,Diaphragm walls.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Apply the concept of soil reinforcement
2. Perform ground improvement based on grouting and exclusion techniques
3. Design earth retaining structures, diaphragm walls and stone columns

Text Books:

1. *Raj Parshotham; Geotechnical Engineering, Pearson Education(2009).*
2. *F.G. Bell; Engineering Treatment of Soils, E & FN Spon Publishers, UK (2004).*

Reference Books:

1. *Moseley M.P.; Ground Improvement, Blackie A&P (2000).*
2. *Saran Swami; Reinforced Soil and its Engineering Applications, I.K. International(2010).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE795: PROJECT

L	T	P	Cr
1	0	8	9

Course Objectives: To expose students to a design problem related to various disciplines of civilengineering.

The project work shall consist of various components related to design of structures, geotechnical investigations, water supply distribution system, irrigation engineering and highway design. The student is supposed to take up any three of these projects. They shall be evaluated on the basis of project report and viva-voce examination.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Apply principles of geotechnical investigations in designing super structures
2. Use design codes
3. Solve design problems related to structure, highway, water supply, and irrigation
4. Function as a member of the design team
5. Write effective reports and improve presentation skills

UCE796: PRACTICAL TRAINING

L	T	P	Cr
-	-	-	4

Course Objectives: To have extensive on-site exposure to various civil engineering aspects.

The students of the alternate scheme shall have to undergo a six weeks industrial training in the summer vacations. They can take up the training at a design office, construction or related sites etc. After completion of their training they have to submit a project report and also make a presentation in front of a panel of internal faculty members only.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Employ technical knowledge and state-of-the art practice related to the chosen topic.
2. Enumerate modern construction materials and techniques.
3. Improve presentation skills.

SEMESTER-VIII

UCE804: SEISMIC ANALYSIS AND DESIGN

L	T	P	Cr
3	1	2	4.5

Course Objective: To expose students to the basic concepts of dynamic analysis of single degreeand multiple degree of freedom system. Using these dynamic properties, students will further analyze and design structures subjected to seismic loading as per IS codes.

Introduction: Nature of dynamic loads, earthquake, wind and blast loads, characteristics ofdynamic problems, method of discretization etc.

Theory of Vibrations: Formulation of Equation of Motions: Free and forced vibrations of singledegree of freedom systems, damping and its effects, transient vibration, response spectrum theory. Analysis of SDOF structures subjected harmonic and impulse loading.

Multi-degree of freedom systems: Review of formulation of flexibility and stiffness matrices offramed structures, Mode shapes and frequencies, Rayleigh method for determination of fundamental frequency , Stodola-vianello method for finding modes shapes and corresponding frequencies, orthogonality relationship of modes of vibration, normal mode theory for free vibration

Introduction to Structural Failures due to Earthquake, Case histories of failures.

Introduction to IS: 1893 – 2002*:* Seismic analysis and design of framed structures by equivalentlateral load procedure and dynamic analysis.

Introduction to IS: 13920 – 1993 : Introduction to Ductile Detailing of Structures, Concept ofSoft Story, Design of Shear Walls using IS-13920-1993.

Masonry Buildings : Use of Codes with reference to Masonry Buildings like IS: 4326, IS: 13828,

IS: 13827

Laboratory Work: Perform some basic test on vibration of helical spring, compound pendulum,bifilar suspension. Torsional vibrations of single mass and two mass system. Evaluation of damping properties of materials using free vibration test and to study the various responses (frequency and time response) through a Real time FFT analyzer.

Experimental Project/assignment/Micro Project

Evaluation of seismic loads for the given RCC framed building as per IS 1893-2002.

Course learning Outcome (CLO):

Upon completion of this course, the students will be able to:

1. Evaluate the dynamic properties of single and multi-degree of freedom systems.
2. Evaluate the dynamic properties for SDOF system subjected to harmonic, impulse and arbitrary loading.
3. Evaluate seismic load for a building using equivalent static load procedure as per IS codes.
4. Evaluate seismic load for a building using dynamic analysis as per IS codes
5. Perform ductile detailing of buildings, and design of shear walls as per IS code.

Text Books:

1. *Mario Paz, Structural Dynamics (Theory and Computation), CBS Publishers and Distributors (2004).*
2. *Agarwal, Pankaj and Shrikhande, Manish, Earthquake Resistant Design of Structures, PHI (2006).*

Reference Books:

Chopra A.K., Dynamics of structures, Perason Education (2012).

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UCE805: DESIGN OF STEEL STRUCTURES – II

L	T	P	Cr
3	2	0	4

Course Objective: The objective of this course is to expose students to design of variousindustrial structures and steel bridges.

Plate Girders: Introduction, weight and economic depth, design of flanges, design of web,curtailment of flange plates, intermediate and bearing stiffeners, design of a riveted and welded plate girders, web and flange splice.

Tubular Structures: Permissible stresses, tube columns and compression members, tube tensionmembers, tubular roof trusses, joints in tubular trusses, tubular beams and purlins

Industrial Buildings (Steel Structures)*:*Design of roof trusses and supporting system, Industrialbuilding frames, bracing, crane girders and columns, design of crane girders, analysis of trussed bents.

Steel Bridges: Introduction to suspension bridges, cantilever bridges, cable-stayed bridges.Standard specifications for railway bridges, Railway bridge code. General arrangement of single-track broad-gauge railway bridge with open floor, design of stringers, cross girders, main trusses, top and bottom lateral bracing, complete design of through type truss bridge

Steel Towers: Introduction to steel towers and tower foundations and multistorey steel buildingframes.

Introduction to Pre-engineered steel buildings

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Analyze and design plate girder bridges and truss bridges
2. Analyze and design different components of industrial buildings
3. Design tubular and aluminum structures
4. Analyze and design transmission line towers

Experimental Project/assignment/Micro Project

Students will have to submit reports on the design of various structural elements of a steel building.

Text Books:

1. *Subramanian, N., Design of Steel Structures, Oxford University Press (2008).*
2. *Ajmani, J. L. and Arya, A. S., Design of Steel Structures, Nem Chand and Brothers (2000).*

Reference Books:

1. *Dunham, C.W., Planning of Industrial Structures, John Wiley and Sons (2001).*
2. *Gary, W., Steel Designer's Manual, Prentice Hall (2008).*
3. *S. M. A. Kazimi and R. S. Jindal, "Design of Steel Structures", Prentice Hall of India Pvt Ltd (1988).*
4. *M. Edwin, J. Gaylord and J. E. Stallmeyer, "Design of Steel Structures", McGrawHill (2006).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UCE806: DESIGN OF HYDRAULIC STRUCTURES

L	T	P	Cr
3	1	0	3.5

Course Objective: The objective of this subject is to focus on estimation of crop waterrequirement, designing of various hydraulic structures like canal, weir/barrage, canal fall, canal head regulator, canal outlet and cross drainage works.

Crop Water Requirement: Soil-moisture-irrigation relationship, depth andfrequency of irrigation, irrigation efficiencies, consumptive use and its determination, duty and delta relationship

Canal Irrigation: canal distribution system, design of stable channels by Lacey'sand Kennedy's theory,design of lined channels

Design of Impervious floor: Creep theories, Khosla seepage theory, hydraulic jump

Diversion Headworks: component, design of a weir or barrage and canal headregulator, river protection measures

Canal Regulation Works: Canal falls, design of a vertical drop fall and a glacis fall,roughening measures for energy dissipation, cross regulators and distributary's head regulators, canal escape.

Cross Drainage Works: Need, types, selection of suitable CD work, design of CDworks

Outlets: types, design principle of open flume outlet and A. P. M. outlet

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Work out water requirement of crops.
2. Design lined and unlined channels for distribution water
3. Learn the function, components and design of headworks
4. Learn the function, components and design of canal regulation works and related hydraulic structures.
5. Learn different types of cross drainage works and their design aspects

Text Books:

1. *S.K. Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi(2014)*

2. *P.N.Modi, Irrigation Water Resources and Water Power Engineering, Standard Book House, New Delhi(2014)*

Reference Books:

1. *Bharat Singh, Fundamentals of Irrigation Engineering, Nem Chand, Roorkee(1988)*

2. *S.R. Sahasrabudhe, Irrigation Engineering and Hydraulic Structures, S K Kataria& Sons, New Delhi(2014)*

3. *P Novak, A I BMoffat, C Nalluri& R Narayanan, Hydraulic Structures, Taylor & Francis(2014)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE892: CAPSTONE PROJECT

L	T	P	Cr
0	0	3	8

Project Objectives: The main objective of the project is to encourage students to think critically,solve challenging problems, and develop skills through experimental/analytical projects. The idea is to provide an opportunity to the students so that they are able to apply what they have learned throughout the course of their graduate program by undertaking a specific idea.

Project Details: A capstone project will be a multifaceted assignment that will serve as aculminating academic experience for students during their final semester of graduate program. The projects will be of interdisciplinary nature that will require students to apply skills or investigate issues across many different subject areas that they would have studied in all previous semesters.

While undertaking the project, students will have go through a step wise procedure:

Step 1: Students in a team of 5-7 will be asked to select a topic that interests them and discuss itwith the faculty who will be assigned to mentor the given team of students. At this stage, the students will give a brief note of problem or question being investigated such as what is the problem, why is it important and what is to be done and how including preliminary bibliography or literature review.

Step 2: Once the topic is decided, the student will start working on the subject and would regularlyupdate the mentor on his/her progress.

Step 3: Students will create a final product/results, demonstrating their learning acquisition orconclusions in the form of a report. The student will be asked to give an oral presentation on the project to a panel of experts who will collectively evaluate its quality. Typically, no grades will be awarded to students until the panel of experts approve of the project.

Project Outcomes (PO):

Upon completion of this course, the students will be able to:

1. Inculcate the spirit of teamwork while synthesizing all aspects of problem including technology and information
2. Develop oral and writing skills, while preparing for the project report
3. Procure in depth knowledge of recent advancements in the chosen area of the project.
4. Develop research skills that will prepare them for higher studies

Reference Books:

1. *Ajmani, J. L. and Arya, A. S., Design of Steel Structures, Nem Chand and Brothers.(2000)*
2. *Duggal, S.K. Limit State Design of Steel structures, McGraw Hill(2014)*
3. *Gambhir, M. L., Reinforced Concrete Design, Prentice Hall of India.(20103)*
4. *GopalRanjan& A.S.R. Rao, Basic and Applied Soil mechanics, New Age Publisher, New Delhi(1998)*
5. *Kohli D. D.; A Text book on Estimating and Costing and Accounts, S. Chand & Company New Delhi(2004)*

6. *Peavy, Rowe and Tchobanglous, Environmental Engineering, McGraw Hill.(2013)*

7. *Reddy, Jaya Rami., A textbook of Hydrology, University Science Press, New Delhi (2015)*

8. *P.N.Modi, Irrigation Water Resources and Water Power Engineering, Standard Book House, New Delhi(2014)*

9. *B. Sengupta and H. Guha; Construction Management and Planning, Tata McGraw Hill.(1999)*

Evaluation Scheme:

Internal Evaluation (by Faculty Advisor)		**External Evaluation (Presentation/viva)**	
Component	**Max. Marks**	**Component**	**Max. Marks**
Work output/Quality + Individual member contribution/Interaction	20+20	Technical content	25
		Questionnaire	20
Final report	10	Presentation quality	05
Total	**50**	**Total**	**50**

UHU005: HUMANITIES FOR ENGINEERS

L	T	P	Cr
2	0	2	3.0

Course Objectives: The objective of the course is to understand the interplay between, psychological, ethical and economic principles in governing human behaviour. The course is designed to help the students to understand the basic principles underlying economic behaviour, to acquaint students with the major perspectives in psychology to understand human mind and behavior and to provide an understanding about the how ethical principles and values serve as a guide to behavior on a personal level and within professions.

UNIT I: PSYCHOLOGICAL PERSPECTIVE

Introduction to Psychology: Historical Background, Psychology as a science. Different perspectives in Psychology.

Perception and Learning: Determinants of perception, Learning theories, Behavior Modification.

Motivational and Affective basis of Behaviour: Basic Motives and their applications at work. Components of emotions, Cognition and Emotion. Emotional Intelligence.

Group Dynamics and Interpersonal relationships.

Development of self and personality.

Transactional Analysis.

Culture and Mind.

Practicals:

1. Experiments on learning and behaviour modification.
2. Application of Motivation Theories: Need based assessment.
3. Experiments on understanding Emotions and their expressions.
4. Personality Assessment.
5. Exercises on Transactional analysis.
6. Role plays, case studies, simulation tests on human behaviour.

UNIT II: HUMAN VALUES AND ETHICAL PERSPECTIVE

Values: Introduction to Values, Allport-Vernon Study of Values, Rokeach Value Survey, Instrumental and Terminal Values.
Value Spectrum for a Good Life: Role of Different Types of Values such as Individual, Societal, Material, Spiritual, Moral, and Psychological in living a good life.
Moral and Ethical Values: Types of Morality, Kant's Principles of Morality, Factors for taking ethical decisions, Kohlberg's Theory of Moral Development.
Analyzing Individual human values such as Creativity, Freedom, Wisdom, Love and Trust.
Professional Ethics and Professional Ethos, Codes of Conduct, Whistle-blowing, Corporate Social Responsibility.

Laboratory Work:

Practical application of these concepts by means of Discussions, Role-plays and Presentations, Analysis of Case studies on ethics in business and CSR.

UNIT III: ECONOMIC PERSPECTIVE

Basics of Demand and Supply

Production and cost analysis

Market Structure: Perfect and Imperfect Markets.

Investment Decisions: capital Budgeting, Methods of Project Appraisal.

Macroeconomic Issues: Gross domestic product (GDP), Inflation and Financial Markets.

Globalisation: Meaning, General Agreement on Trade and tariffs (GATT), World Trade Organisation (WTO). Global Liberalisation and its impact on Indian Economy.

Laboratory Work:

The practicals will cover numerical on demand, supply, market structures and capital budgeting, Trading games on financial markets, Group discussions and presentations on macroeconomic issues. The practicals will also cover case study analysis on openness and globalisation and the impact of these changes on world and Indian economy.

Micro Project: Global Shifts and the impact of these changes on world and Indian economy.

Course Learning Outcomes (CLO):

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

1. Improve the understanding of human behavior with the help of interplay of professional, psychological and economic activities.
2. Able to apply the knowledge of basic principles of psychology, economics and ethics for the solution of engineering problems.
3. Explain the impact of contemporary issues in psychology, economics and ethical principles on engineering.

Text Books:

1. *Morgan, C.T., King, R.A., Weisz, J.R., &Schopler, J. Introduction to Psychology, McGraw Hill Book Co(International Student (1986).*
2. *A. N. Tripathi**,** Human Values**,** New Age International (P) Ltd (2009).*
2. *Krugman, Paul and Wells Robin, Economics, W.H. Freeman & Co Ltd. Fourth Edition (2015).*
3. *RubinfeldPindyck. Microeconomic Theory and application, Pearson Education New Delhi (2012).*
4. *Samuelson, Paul, A. and Nordhaus, William, D. Economics, McGraw Hill, (2009).*
5. *Mankiw, Gregory N. Principles of Macroeconomics, South-Western College Pub., (2014).*
6. *Gregory, Paul R. and Stuart, Robert C. The Global Economy and Its Economic Systems, 2013South-Western College Pub (2013).*

Reference Books:

1. *Atkinson, R.L., Atkinson, R.C., Smith, E.E., Bem, D.J. and Nolen-Hoeksema, S. (2000). Hilgard's Introduction to Psychology, New York: Harcourt College Publishers.*
2. *Berne, Eric (1964). Games People Play – The Basic Hand Book of Transactional Analysis. New York: Ballantine Books.*

3. *Ferrell, O. C and Ferrell, John Fraedrich Business Ethics: Ethical Decision Making & Cases, Cengage Learning (2014).*
4. *Duane P. Schultz and Sydney Ellen Schultz, Theories of Personality, Cengage Learning, (2008).*
5. *SaleemShaikh. Business Environment, Pearson (2007).*
6. *Chernilam, Francis International Buisness-Text and Cases, Prentice Hall (2013).*
7. *Salvatore, Dominick, Srivastav, Rakesh., Managerial Economics: Principles with Worldwide Applications, Oxford, 2012.*
8. *Peterson H. Craig. and. Lewis, W. Cris. Managerial Economics, Macmillan Pub Co; (1990).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	45
3	Sessionals (Include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	30

ELECTIVE-I

UCE831: BRIDGE ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course Objectives: The course introduces various components of bridges and their various typesand hydraulic design requirements of bridges. Standard loading standards developed by IRC which form a consistent basis for design are introduced. The course provides a lucid exposition of the theory and design of pipe culverts, RC slab culverts, T- Beam Bridges and introduction to pre-stressed concrete bridges. The course covers the theory and design of substructures (piers and abutments), foundations, bearings and joints and introduces construction and maintenance as an important part of bridge engineering.

Introduction: Definition, components of a bridge, classifications, importance of bridges.

Investigation of Bridges: Need for investigations, selection of bridge site, preliminary data to becollected, design discharge and its determination, linear waterway, economical span, vertical clearance above HFL, scour depth, choice of bridge type

Standard Specifications: Road bridges, I.R.C. loadings, code provisions on width of carriageway,clearances, loads considered etc.

Slab type Bridges: Design of R.C.C. Orthogonal and Skew Culverts

Reinforced Concrete Bridges: T-Beam Bridge, Courbon's theory for load distribution. Balanced cantilever bridges, Pre-stressed concrete bridges (General discussions)

Sub Structure: Types of piers and abutments, design forces, design of piers and abutments.

Bearing and Joints: Various types of expansion bearing and fixed bearings, elastomeric bearings,joints and their types, design of bearings

Construction, inspection and maintenance of bridges including case studies

Introduction to suspension bridges, cantilever bridges, cable-stayed bridges

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Specify various sub-surface investigations required for bridge construction and further use them to calculate the hydraulic design requirements of different bridges.
2. Implement standard loading specifications for bridge design followed by IRC codes.
3. Analyze and perform design of RC slab culverts and RC T-Beam Bridges
4. Analyze and design various elements of sub-structures of a bridge
5. Design various types of bearings and joints in bridge structures.

Text Books:

1. *Victor, D. Johnson, Elements of Bridge Engineering, Oxford and IBH Publishers, New Delhi(2009)*
2. *Vazirani&Ratwani, Design of Concrete Bridges, Khanna Publishers, New Delhi(2010)*

Reference Books:

1. *Raina, V.K., Analysis, Design and Construction of Bridges, Tata McGraw Hill(2010)*
2. *Raju, N. Krishna, Design of Bridges, Oxford and IBH .(2004)*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weights (%)**
1.	Mid Semester Test	30
2.	End Semester Test	50
3.	Sessionals (May include assignments, project and quizes)	20

UCE833: WATER RESOURCES PLANNING AND MANAGEMENT

L	T	P	Cr
3	1	0	3.5

Course Objective: To expose students to gain the knowledge on planning and economics of waterresources project. Various aspects of water resource planning such as single and multipurpose projects, their feasibility based on cost allocation and comparison of alternatives will be taught along with application of optimization techniques to water resource problems.

Introduction: Role of water in development of water resources, Assessment of water resources ofthe country, Requirement for various uses, Future of water resources engineering.

Planning and Management: Issues in planning, Water resources planning process, Planning forsingle purpose and multipurpose projects, Principles of multipurpose development; Functional requirement of multipurpose uses, Compatibility of multipurpose uses, Cost allocations in multipurpose projects, Comparison of alternatives, Inter-basin transfer of water, Conjunctive use of surface and ground water.

Project Economics: Basic principles, Tangible and intangible values, Selection of interest rate,Cash flow diagrams Discounting factors, Discounting techniques - present-worth method, annual-cost method, benefit-cost ratio method, rate of return method, Risk and uncertainty, Application to water resources problems.

Optimization Techniques: Linear and Dynamic programming, Application to water resourcesproblems.

Dams: Types, classification, factors governing the selection of a dam, Design of gravitydams: Analysis of forces, combination of forces for design, modes of failure and criteria for structural stability, principal and shear stresses, methods of analysis (detailed description of gravity method only).

Spillways: Location, types, design considerations of ogee spillway, energy dissipation belowspillways, design of stilling basins.

Reservoir Planning: Types of reservoirs, storage zones, selection of reservoir site, mass curveanalysis for reservoir capacity, reservoir yield and its determination, reservoir sedimentation and its control, reservoir evaporation and methods for its reduction.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Perform economic analysis of water resource project.
2. Apply optimization techniques to water resources problems
3. Analyze the criteria of stability of gravity dams and its design features
4. Evaluate the capacity of reservoir based on site specific data

Text Books:

1. *Chaturvedi, M. C., Water resources Planning and Management, Tata MC Graw Hill, New Delhi (1997)*

2. *Garg, S. K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, New Delhi(1993)*

Reference Books:

1. *James, L. D., and Lee, R. R., Economics of Water Resources Planning. McGraw Hill Publishing Company, New York(1971)*

2. *Chow, V. T. et. al., Applied Hydrology, McGrawHill Publishing Company, New York. (1988)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE834: ADVANCED TRANSPORTATION ENGINEERING

L	T/P	Cr
3	1	3.5

Course Objectives: To expose students to various concepts of pavement design & traffic engineering.

Design of bituminous mixes: Requirement of bitumen mixes, design of bituminous mixes as perMarshall Stability & flow method, parametric evaluation of bituminous mixes, I.R.C & MORTH recommendations for the design mix of various layers of flexible pavements.

Structural design of Flexible Pavements: Stresses in flexible pavements, theories of stressdistribution, Boussinesq's Elastic theory, Burmister's theory, considerations for flexible pavement design, IRC method & other countries method for the design of flexible pavements, AASHTO method of Pavement design, Analytical methods of pavement design, overlay design.

Structural design of Rigid Pavements: Stresses in rigid pavements,Westergaard method of rigidpavement design, IRC method of rigid pavement design for plain dowel jointed slabs, design of joints and load transfer devices; design of tie bars, joint fillers and sealers, design of continuously reinforced concrete pavements, design of thin & ultra-thin white toppings as overlay.

Soil Stabilized Roads: Methods of soil stabilization, mechanical stabilization, stabilization withadditives/admixtures like lime, cement and bitumen. Stabilization of problematic soils like desert sand & black cotton soils.

Traffic Planning& control: Fundamental principles of Traffic Flow, Traffic flow Elements, FlowDensity Relationships, Traffic signs, Road markings, traffic signals, type's i.e. simultaneous system, alternate system, simple progressive system and flexible progressive system, general principles of signal design, Roadway delineations, object markers, guard rails, Barriers.

Highway capacity& Intersection design: PCU, Level of service concepts, factors affectingcapacity, capacity of urban highways, capacity of rotary intersection, Design of intersection, grade separated intersection, Need for rotary intersection, principles of design, design of rotary intersection.

Pavement Management Systems: Concepts of Pavement life cycle, Pavement performance assessment, evaluation of pavement structural capacity and safety, combined measures of pavement quality, development of models for pavement deterioration, rehabilitation and maintenance strategies, Future directions and need for innovations in pavement management, HDM applications.

Laboratory Work:

1. Plate bearing test.
2. Stability and Flow value test of bituminous mix as per Marshall Criteria.
3. Evaluation of pavement by Benkelman beam.
4. Evaluation of pavement roughness by Bump Integrator.
5. Introduction to highway engineering softwares(HEADS, MX Road and HDM4)
6. To conduct Pavement Deterioration tests.

Course learning Outcomes:

Upon completion of this course, the students will be able to:

1. Design the bituminous mixes as per IRC standards.
2. Design rigid and flexible pavements using various methods.
3. Apply the concepts of traffic engineering including traffic control, control aids, regulations, highway capacity, and design of intersections.
4. Design pavement maintenance management systems for the road networks.

Text Books:

1. *Khanna S.K. and C.E.G. Justo, "Highway Engineering", Nemchand Bros, (2002)*
2. *Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee(2002)*

Reference Books:

1. *Sharma & Sharma; Principle and Practice of Highway Engineering, Asia Publishing House, New Delhi (1980).*
2. *Road Development plan for India (1981-2001), IRC, New Delhi, (1984).*
3. *Rao G. V.; Transportation Engineering, Tata McGraw Hill Publisher, New Delhi*
4. *Highway Materials, H.M.S.O.(London).*
5. *Yoder E. J.; Principles of Pavement Design, John Wiley & Sons, (October 1975)*
6. *Haas R.C.G. , Hudson W. Ronald., Zaniewski John P., Modern Pavement Management, Krieger Publishing Company, 1994.*
7. *Susan Brown, Pavement Managaement Systems, Transportation Research Board, 1993.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE847 : ENVIRONMENT LEGISLATION AND IMPACT ASSESSMENT

L	T	P	Cr
3	1	0	3.5

Course Objectives: The basic objective of the course is to provide the students with an overview on the environmental legislation and acts and role of pollutionand their procedures, provide understanding of various aspects related to EIA processes and Inculcate capabilities to interpret environmental management plans and EIA documents

Definition of Terms: Conventions and protocols; Policy; law; acts and rules;Administrative and legal interpretations; Codes and specifications.

Overview of environmental Legislation: International environmental Conventions andprotocols, History of development, Overview of Indian environmental law; Review of Environment and Forest policies of Government of India; Pollution control boards – Powers; functions and Procedures. Judgements on Environment and pollution.

Provisions of Water Act; Water-cess Act; Air Act; Environmental Protection Act; Public Liability Insurance Act as Applicable to Industry: Provisions relating to Environmentalclearance; Consents from SPCB; Environmental sampling; analysis and Environmental standards; Overview of other key environmental regulations- Municipal solid waste rules; Biomedical waste rules; Hazardous waste rules, Chemical accident rules, Batteries rules, flyash rules, construction and demolition waste rules.

Legal Aspects of EIA: EIA notification; Environmental clearance process - Screening;scoping; public consultation and appraisal; Objectives and scope of EIA; EIA process flow chart.

Project and the Environment Description: Environmental feasibility analysis;Identification of key issues; Baseline studies; environmental monitoring and environmental data collection- air, water, noise, socioeconomics: Methods of Impact analysis and evaluation-checklists; matrices; networks; overlays and GIS; and professional judgements etc.

EMP (Environmental Management Plan) and EIA Documentation:
Principles;anticipated environmental impacts; mitigation measures: Preparation of EIA documents.

Case Studies: EIA of highway, infrastructure and hydel power projects.

Course Learning Outcomes:

Upon completion of this course, the students will be able to:

1. Be aware of the environmental legislations, policies of the country and of international environmental conventions and protocols.
2. Know the environmental regulations applicable to the industry and other organizations with significant environmental aspects
3. Know about the environmental requirements applicable to the environmental impact assessment, and about the environmental clearance process of developmental projects.
4. Understand the methods and tools of identification, prediction and evaluation of environmental impacts of developmental projects.

Recommended Books:

1. *CPCB, Pollution Control Law Series - PCL/2/2001; Central Pollution Control Board (http://envfor.nic.in/cpcb/cpcb.html)*
2. *L.W Canter, Environmental impact assessment, McGraw Hill (1989)*
3. *EIA notification, Gazette Notification: SO 1533 dated 14-09-2006; MOEF. GOI (2006).*
4. *KrishanKeshav, Law and environment, Singhal Law Publication, New Delhi (2015)*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (Assignments/Tutorials/Quizzes)	25

ELECTIVE-II

UCE723: GROUND WATER ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course Objective: The objective of this subject is to get exposure on engineering aspects ofgroundwater such as groundwater hydraulics, an introduction to groundwater quality and groundwater exploration.

Principles of Ground water flow: Definition and occurrence of ground water flow, Role ofground water in a hydrologic cycle, Mechanical energy and fluid potential, Hydraulic head, Darcy's law, Heterogeneity and anisotropy, Range and validity of Darcy's law, Types of aquifer and its properties, Compressibility, Specific storage, Storativity, Ground water flow equation, Solution of flow equation, Analytical solutions, Steady flow in a confined and unconfined aquifer, Graphical solutions, Flow lines and Equipotential lines, Flow net, Refraction of flow lines.

Well Hydraulics: Introduction, Drawdown due to abstraction from well, Steady and unsteadyabstraction from well, Well interference, Pumping test analysis, Infiltration wells and gallery.

Well Construction: Method of construction of shallow and deep well, well log, well completion,horizontal well

Groundwater Conservation: Regional groundwater budget, Resource assessment, Estimation of recharge, artificial recharge.

Groundwater quality: Indian and international standards, Pollution of groundwater sources, Advection and dispersion, sorption and diffusive mass transfer, remedial and preventive measures.

Exploration: Geophysical, Electric resistivity method, Seismic refraction method, Saline water intrusion in aquifers, Groundwater levels fluctuation.

Course Learning Outcome (CLO):

Upon completion of this course, the students will be able to:

1. Learn the principles of groundwater flow and its representation in mathematical equation.
2. Estimate the discharge in well for different aquifers.
3. Learn the method of well construction
4. Learn the source and mechanism of contaminant transport in groundwater

5. Learn the methods of groundwater of exploration and the reasons of groundwater fluctuation.

Text Books:

1. *Raghunath H M, Groundwater, New Age International (2007).*
2. *Franklin W. Schwartz and Hubao Zhang, Fundamentals of Groundwater, John Wiley (2003).*

Reference Books:

1. *David Keith Todd, Groundwater Hydrology, Wiley India Edition(2007)*
2. *Bear, J. Hydraulics of Groundwater, McGraw-Hill(1979).*
3. *Freeze, R.A. and Chery, J.A, Groundwater. Prentice Hall,Inc, Englewood Cliffs, New Jersey(1979).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weights (%)**
1.	Mid Semester Test	30
2.	End Semester Test	50
3.	Sessionals (Includes Assignments and Quiz Evaluations)	20

UCE724: SITE ORGANIZATION AND SAFETY MANAGEMENT IN CONSTRUCTION

L	T	P	Cr
3	1	0	3.5

Course Objective: To purpose of this course is to expose the students to various aspects ofconstruction site starting from preparation of site to various safety management measures.

Preparation of Site: Site Clearance, Layout, infra-structural facilities, organizing utilities, sitegrading legal frame-work, liaison with local authorities, acquisition of land Various levels, job description, role of consultants, contractor and client and their responsibilities, training, Job layout, placement of material equipment on site. Documentation, inspection, Machinery, stores equipment, contractor, Quarries, vendors

Supervision: Procedure for quality assurance, Controlling and reporting system, Labour laws,legislation.

Safety Management: Safety management function, line versus staff authority, safetyresponsibility and accountability in construction industry. Safety and its importance in construction industry, hazards in construction projects, causes of accidents, cost of an accident. Experience Modification Rating, Workers insurance, general safety programs in construction industry, construction safety problems, Systems safety analysis, faulty tree analysis, failure modes and effects analysis in construction industry. Introduction to Risk assessment and management, Health and safety legislation and regulations and, Safety management systems.

Course learning Outcome (CLO):

Upon completion of this course, the students will be able to:

1. Execute various preparatory steps involved in construction project execution at site
2. Perform various organizational activities involved in project management at site
3. Work out safety provisions to be adopted at a construction site

Text Books

1. *B. Sengupta and H. Guha; Construction Management and Planning, Tata McGraw Hill.(1999)*
2. *R.L. Peurifoy, W.B. Ledbetter and C.J. Schexnayder, Construction planning and methods, McGraw Hill International edition.(1996)*

Reference Books

1. *P.K. Joy; Total Project Management – The Indian Context, McMillan India Ltd.(2010)*
2. *P.K. Joy; Hand Book for Construction Management, MacMillan India Ltd. (1991)*
3. *Hand Book on Labour Contract Legislation, ILO(2015)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May includeAssignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE725: ADVANCED CONSTRUCTION MATERIALS AND TECHNIQUES

L	T	P	Cr
3	1	0	3.5

Course Objectives The basic objective of the course is to expose the students to the latest andadvanced construction materials used for thermal and sound insulation and special concretes used for specific field applications. The students will also be introduced to newer and latest construction techniques followed in construction industry.

Advanced Construction Materials: Plastics, Timber products and Preservation, materials forthermal insulation, materials for sound insulation.Smart Materials and their applications.

Special Concretes: Light Weight Concrete, Vaccuum Concrete, Waste Material Based Concrete,Fiber reinforced concrete, Polymer Concrete Composites, Ferrocement, Concreting at High and Low Temperatures, Self- Compacting Concrete (SCC), Ready Mixed Concrete (RMC) and its characteristics and advantages, Shotcrete and concreting in tunnels.

Techniques for Tunneling and Formwork*:*Earthwork including cut and cover method, TBM,EBM and trenchless technology, Slip Form Shuttering, Latest type of Formwork, e.g. DOKA.

High Rise Structures: Construction techniques for high rise buildings, chimneys, dams. Specialproblems of high-rise construction & optimization of space,

Fire Resistance in Structures*:*Fire hazards in buildings and preventive measures,

Low Cost Housing: Types, Design and advantages.

Special Constructions: Pre-Cast and Pre-Fabricated Construction and Modular Construction,production and utilization in various types of structures, Environmental and Economic Benefits.

Course Learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Characterize and specify advanced construction materials for thermal and sound insulation, smart materials and plastic and timber products.
2. Identify Special Concretes used in construction industry for specific applications.
3. Identify and Specify construction techniques for earthwork, tunneling and formwork.

4. Identify the various construction techniques for High Rise Buildings.
5. Know how to Design Low Cost Housing and cost analysis of In- Situ Pre-Cast, Pre-Fabricated and Modular construction.

Text Books

1. *M.L. Gambhir , Neha Jamwal, Building Materials, Products, properties and systems, McGraw Hill(2011)*
2. *M.L. Gambhir, Concrete Technology, McGraw Hill(2013)*
3. *Subir Sarkar, Subhajit Sarawati, Construction Technology, Oxford University Press (2008).*

Reference Books/Journals:

1. *Low Cost Houses, Publications by HUDCO, India Habitat Centre, Lodhi Road, New Delhi(1982)*
2. *F. Glower, Structural Pre-cast Concrete, Oxford Publishers.(1974)*
3. *Neil Jackson and R. K. Dhir, Civil Engineering materials, Macmillan Fourth edition.(1996)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weights (%)
1.	Mid Semester Test	30
2.	End Semester Test	50
3.	Sessionals (Includes Assignments and Quiz Evaluations)	20

ELECTIVE-III

UCE832: GEO-TECHNIQUES

L	T	P	Cr
3	1	0	3.5

Course Objectives: This subjects aims to develop the understanding for design of earthretaining structures, open cuts, and introduce the concepts of earth dam and foundations on expansive soils.

Sheet Piles and Cofferdams: Types of sheet piles, principal advantages of sheet piles, analysisof cantilever wall in sands, simplified approach in clays (= 0), Anchored bulk head stability, Free earth support method, fixed earth support method Types of cofferdams, relative merits and their advantages as compared to other types, comparison between circular and diaphragm types, failure modes of cells, stability analysis of cofferdams by TVA method.

Design of Bracing in Open cut: Open cuts, necessity of bracing and strutting in open cuts,pressure distribution diagram under various cases, deep open cut in loose and dense sands, deep open cut in normally loaded and stiff clays. Heaving of vertical cuts in clay, Design of anchors.Earth Dams: Criteria for selection of dams, material required in earth dam construction, types of Earth dams, compaction control during construction of dams, method of measuring field density and moisture content. Control of seepage, through body of dam and through its foundations.

Arching Action in Soils: Arching in soil, theory of arching in soils, practical utility of arching invarious field problems.

Foundation on expansive soils: Introduction mineralogy, identification testing techniques,swelling pressure, types, practice, methods of foundation in expensive soils, CNS Concepts. Design of shallow and deep foundation in swelling soils. Design of under reamed piles

Dewatering: Approximate computation for flow quantity to dewater an excavation, slurry walland safety factor.Simple sketches to illustrate the principles of dewatering by different methods and their relative suitability. Ditches and sumps, well point system, deep well drainage installation, vacuum method Bleeder wells, sand drain installation, electro-osmosis. Design of well point system for dewatering.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Design the cantilever and anchored sheet pile
2. Design the bracing system in open cuts and anchoring

3. Apply design aspects of earth dams.
4. Design the foundations on expansive soils.
5. Design the well point system for deep excavations.

Text Books:

1. *Murthy,VNS., Advanced Foundation Engineering, CBS, New Delhi (2007)*
2. *Ranjan,Gopal& ASR Rao; Basic and Applied Soil Mechanics, New Age Publishers, New Delhi (2004)*

Reference Books:

1. *Bell, F., Engineering Treatment of Soils, Chapman and Hall, UK (2001)*
2. *Saran, Swami; Analysis and Design of Substructures, Oxford and IBH, New Delhi (2005)*
3. *Bowles, Foundation Analysis & Design, McGraw Hill Publishing Co., New Delhi (1996)*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE844: REMOTE SENSING AND GIS

L	T	P	Cr
3	1	0	3.5

Course Objective: The purpose of this course is to expose students to the principles of remotesensing, sources of errors in raw data before its application, including data handling in GIS and to be able to learn the application of remote sensing in Civil and Environmental Engineering.

Principles and Fundamentals of Remote Sensing: Sources of Energy–Active and Passiveradiation – Electromagnetic Radiation – Nomenclature, Reflectance, Transmission and Absorption, Thermal Emission – Plank's formula, Stefan – Boltzman Law, Wein's Displacement Law; Emissivity – Kirchoff's Law, Characteristics of Solar Radiant Energy.

Sensors and Platforms: Types of sensors, Multispectral, hyperspectral, thermal, orbitalcharacteristics, working principles and instrumentation. Storage and Retrieval of data. IRS and ERS satellite systems – Introduction, Stages of development, Sensory Characteristics, Orbit and Coverage's, various types of data product and its uses.

Data Processing: Initial data statistics. Pre-processing–Atmospheric, Radiometric andGeometric corrections.

Data analysis: Image Interpretation Elements, Keys and Aids. Basic Instrumentation. Visual analysis of data in application of remote sensing to various engineering fields.

Digital Elevation Model: Principles of data collections; Application to various fields: Contours,profiles, watersheds, stream networks etc.

Principles of Geographical Information Systems (GIS): Geographic information and spatialdata types, Hardware and software; GIS; Steps of spatial data handling, database management systems, Spatial referencing.

Data*:*Quality, measures of location errors on maps, Satellite-based positioning, Spatial datainput, data preparation, Point data transformation.

Analytical GIS capabilities: classification; overlay analysis

Map Projections: System of map projections.

Lab Assignments:

1. Prepare land use and land cover map.
2. Generate contours and sectional profile from a DEM data
3. Delineate watersheds and stream networks from DEM data
4. Projects of Maps
5. Geometric corrections of satellite data
6. Spatial data processing through GIS.

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Process the remotely sensed data for various field applications.
2. Interpret and classify the remotely sensed data and prepare the land use and land cover maps.
3. Handle DEM data and be able to prepare contours and topographical maps.
4. Delineate the watershed and prepare the stream network of an area.
5. Use spatial information, collected through remote sensing, for the benefits of end users.

Text Books:

1. *Lillesand, T.M. and R.W. Kiefer, Remote Sensing and Image Interpretation, John Wiley & Sons, New York(1994).*
2. *Campbell, J.B, Introduction to Remote Sensing, Taylor & Francis, London (1996).*
3. *Joseph, G., Fundamentals of Remote Sensing, Universities Press, New Delhi (2003).*

Reference Books:

1. *Colwell, R.N. (Editor-in-Chief), Manual of Remote Sensing, Vols I & II, American Society of Photogrammetry, Falls Church, Virginia(1983).*
2. *Jensen, J. R., Remote Sensing of the Environment an Earth Resource Perspective, Pearson Education. Delhi(2007).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
4.	MST	30
5.	EST	45
6.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE845: PRESTRESSED CONCRETE

L	T	P	Cr
3	1	0	3.5

Course Objectives: To expose students about various design aspects of prestressed and posttensioned concrete.

Introduction: Basic concepts of prestressing, terminology, advantages and applications of prestressed concrete.

Materials for Prestressed Concrete: High strength Concrete, permissible stresses in concrete,high strength steel, permissible stresses in steel.

Prestressing Systems: Pretensioning and post tensioning systems, various types of tensioning devices, Lec-Macall systems, Magnel Blaton post tensioning, Freyssinet systems, Gifford Udal system.

Losses of Prestress: Types of losses of prestress, loss due to elastic deformation of concrete,loss due to shrinkage of concrete, loss due to creep of concrete, loss due to relaxation of stress in steel, loss due to friction, loss due to anchorage slip, total loss in pretensioned and post tensioned members.

Analysis of Prestress and Bending stresses: Basic assumptions, resultant stresses at a section,concept of load balancing, cracking moment.

Deflections: Factors influencing deflections, short term deflections of un-cracked members,deflections of cracked members, prediction of long term deflections.

Shear and Torsional Resistance: Ultimate shear resistance of prestressed concrete members,prestressed concrete members in torsion, design of reinforcements for torsion, shear and bending.

Design of Flexural Members : Dimensioning of flexural members, design of pre-tensioned andpost tensioned beams, design of partially prestressed members, design of one way and two way slabs, continuous beams.

Design for axial tension, compression and bending, bond and bearing.

Limit State Design: Review of limit state design concepts, design loads and strengths, crack widths in prestressed members, principles of dimensioning prestressed concrete members.

Course learning Outcomes:

Upon completion of this course, the students will be able to:

1. Specify and characterize the materials required for prestressed concrete structures and various methods of prestressing.
2. Calculate losses in various pre-stressed members.
3. Analyze prestressed concrete members for flexure and their flexural strength.
4. Design various prestressed concrete structures for bending, axial tension, bond and bearing.
5. Evaluate shear and torsional resistance of pre-stressed concrete members and perform check for deflection criteria.

Text Books

1. Raju, N. Krishna, Prestressed Concrete by, TMH Publishing Company, New Delhi (2006).

Reference books

1. Dayartnam,, P., Prestressed Concrete , Oxford and IBH Publication, New Delhi.(1991)

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE846: SOIL DYNAMICS AND MACHINE FOUNDATION

L	T	P	Cr
3	1	0	3.5

Course Objective: This subjects aims to develop an understanding of behavior of soil masswhen subjected to vibratory loads. Further they will also develop an understanding of liquefaction of soil.

Dynamic properties of soils: Nature of dynamic loads, Stress conditions during earthquakeloading, strain levels, Determination of dynamic properties – in-situ and laboratory methods, Block vibration tests, Cyclic plate load test, Cyclic resonant column test, Cyclic triaxial test, Cyclic simple shear test, Wave propagation tests, Interpretation of test results.

Dynamic Earth Pressure: Earth pressure problem and retaining walls, Behavior of retainingwalls during earthquakes, Modification of Coulomb's theory, Indian standard code of practice, Culmann's modified graphical constructions for lateral earth pressure, Simplified analytical solution for c-□ backfill.

Liquefaction of Soils: Basic concept, Liquefaction related phenomena, Factors influencingliquefaction susceptibility of soils, factor of safety against liquefaction, Cyclic shear stress ratio, Cyclic resistance ratio and its determination from SPT, CPT and shear wave velocity, Laboratory studies on liquefaction, Liquefaction behavior of loose and dense sands; silt and clayey silts, Methods of liquefaction remediation.

Machine Foundations: Theory of vibrations, Single degree and multi-degree of freedomsystem, Criteria for satisfactory functioning of machine foundation, Methods of analysis, Degrees of freedom of a block foundation, Vibrations of a block, Design procedure for block foundation. I.S. method for foundation design of reciprocating machines, Vibration isolation.

Introduction to the dynamics of dams and reservoirs

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Know theoretically how to evaluate dynamic properties of soils by geotechnical and geophysical methods.
2. Understand the stress-strain behaviour of cyclically loaded soils.
3. Evaluate the liquefaction potential of soil deposits.
4. Perform analysis and design of retaining walls and dynamic loading.
5. Perform analysis and design of machine foundations.

Text Books:

1. *Saran, Swami, Soil Dynamics and Machine Foundations, Galgotia, New Delhi (2008).*
2. *Kramer, S. L., Geotechnical Earthquake Engineering, Pearson Education, Inc, India(1996).*
3. *Prasad B.B., Soil Dynamics and Earthquake Engineering, PHI Learning Private Ltd (2009).*

Reference Books:

1. *Prakash, S., Soil Dynamics, McGraw Hill International Edition, New York. Publishing, New Delhi (1994).*
2. *Barken, D.D., Dynamics of Bases and Foundations, McGraw Hill Book Company, New York (1995).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE848 :TRANSPORTATION PLANNING AND MANAGEMENT

L	T	P	Cr
3	1	0	3.5

Course Objective: To expose the students to various concepts of transportation planning onurban platform, Land use planning, use of transportation modelling in travel demand management and public transit studies.

Overview of Metropolitan Transportation Planning: History of urban transportation planning,early concepts and approaches (Pre 1964 Era); Contemporary Urban Transportation Planning and Apex bodies that constitute the framework of the planning process in India; Legislative measures regarding transportation planning in India.

The Transportation Planning Process and Problems: Terminology of TransportationPlanning, Functional Components, Brief Overview of Models used in Transportation Planning, Stakeholder input in the planning process, Environmental concerns, Smart growth and sustainable alternatives, Energy based planning, Intelligent Transportation Systems, Global Positioning Systems.

Transportation System Impacts: Travel Facilities, Origin and Destination, Transit Surveys,Decision making Process, Transportation Demand Management (TDM).

Modeling: Transportation system characteristics and interrelationships, User costs and HumanActivities, Travel Demand Forecasting, Trip Generation, Trip Distribution, Modal Choice, Trip Assignment.

Land Use Transportation System: Urban system components, Urban Spatial Structure,Location Theory, Land use planning, Land use Models, Land use transport models – (Lowry and Garin), Lowry Models, Transit Oriented Development(TOD).

Urban Public Transportation: Urban Growth and Public Transport needs, Transit modecharacteristics, transit characteristics, Fleet size and capacity estimation, Smart cities bases Transit Planning

Project assignment/ Micro project:

1. Study area delineation
2. Travel Survey Design
3. Home interview survey

4. Data analysis
5. Use of Transportation Simulation Software like VISUM/ TransCAD.
6. Case study: Planning for transportation systems of a specific location.

Course Learning Outcome (CLO):

Upon completion of this course, the students will be able to:

1. Understand the concept of Transportation Planning in the Regional and City level Planning
2. Design Travel Demand and Transit based Surveys.
3. Estimate Travel Demand of a particular corridor, city or area
4. Perform Four Stage Modeling for Travel demand and further Design transportation alternatives for the same.
5. Suggest mass transit alternatives for a given conditions on the base of its characteristics and capacity estimate.

Text Books:

1. Kadiali, L.R.; *Traffic Engineering and Transportation Planning, Khanna Publications,2011.*

2. Sarkar, P.K., MaitriVinay., Joshi, G.J.; *Transportation Planning: Principles, Practicesand Policies, PHI, New Delhi, 2014.*

Reference Books:

1. Bowmen, J. and M. Ben-Akiva;*Activity based travel forecasting; in Activity based travelforecasting. Washington, DC: U.S. Department of transportation, Report DOT-97-17.*

2. Bruton M.J.; *Introduction to Transportation Planning, Hutchinson of London, 1988.*

3. Chakraborty P. and Das N.; Principles of transportation Engineering, PHI, New Delhi, 2003.

4. Dickey J.W.; *Metropolitan Transportation Planning, Tata Mc-Graw Hill 1980.*

5. Hutchinson B.G.; Principals of Urban Transportation System Planning, Mc-Graw Hill, 1974.

6. Khisty C.J., Lall B. Kent, *Transportation Engineering- An Introduction, Prentice-Hall,NJ, 2005.*

7. Ortuzar, J.D., Willumsen, L.G., *Modeling Transport, John Wiley and Sons, 1994.*

8. Papacostas C.S. and Prevedouros, P.D., *Transportation Engineering and Planning, PHI,New Delhi, 2002.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	30
2	EST	45
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UCE849: AIR QUALITY AND CONTROL ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course Objectives

This course facilitates understanding of the sources, dispersion and effects of air pollutants. Principles underlying designing of mechanical devices used for particulate and gaseous emissioncontrol from various sources. To understand the management strategies in the control of air pollution from stationary and mobile sources.

Sources and Effects of Air Pollutants: Classification of air pollutants Particulates and gaseouspollutants, Sources of air pollution, Source inventory, Air Pollution Index, Effects of air pollution, Climate Change, Ozone layer depletion, Sampling and Analysis –Source and ambient sampling, Principles of analysis of pollutants.

Dispersion of Pollutants: Elements of atmosphere, Meteorological factors, Wind roses, Lapserate, Atmospheric stability and turbulence, Plume rise, Dispersion of pollutants, Dispersion model (Gaussian plume model) & its applications, Stack height calculations.

Emission Control: Basic principles of fluid flow, Dynamics of particles in fluid, Properties ofparticles, Collection efficiencies of particles, Design and operation of settling chambers, Cyclone and multiclones, Scrubbers, Bag houses and Electrostatic precipitators, Collection efficiency and Pressure drop calculations, Selection criteria for equipment, Gaseous pollutant control by adsorption, absorption, condensation, combustion, Automobile emission control.

Air Quality Management: Air quality standards, Source reduction (Fuel substitution, Fuelpretreatment, Process modifications), Management strategies for air pollution abatement, Green belt design.

Course Learning Outcomes:

Upon completion of this course, the students will be able to:

1. identify, formulate and solve air pollution problems
2. demonstrate a detailed knowledge of study the effect of meteorological parameters in the dispersion of air pollutants
3. design and evaluate efficiency of various air pollution control devices used for particulate removal
4. design, operate and control the devices used for gaseous emission control
5. examine the management strategies for air pollution abatement

Text Books:

1. De Nevers N, Air Pollution Control and Engineering, McGraw Hill 1993.
2.Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.
3. Boubel RW, Fox DL, Turner B and Stern AC, Fundamental of Air Pollution, Academic Press 1994.
4. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata McGraw Hill, New Delhi, 1996.

Reference Books:

1. Perkins HC, Air Pollution, McGraw Hill (2004).
2. Heumann. W.L., Industrial Air Pollution Control Systems, McGraw Hill, New Yark, 1997.
3. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw Hill Publishing Company, New Delhi, 1991
4. Peavy S.W., Rowe D.R. and Tchobanoglous G. "Environmental Engineering", McGraw Hill, New Delhi, 1985.
5. Flagan RC and Seinfeld JH, Fundamentals of Air Pollution Engineering, Prentice Hall 1988.

Evaluation Scheme:

S.N.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (Assignments/ Projects/ Tutorials/ Quizes/Lab Evaluations)	25

UCE850: HYDROPOWER ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course objective: To get an overview of hydropower systems along with its various units.

Introduction:

Power resources, Conventional and Nonconventional, Need & advantages, Hydropower development in India, Hydropower potential.

Hydropower Plants

Types of hydropower plants, Storage power plant, Runoff River plant, Pumped storage plant, Reversible pump turbines, types of turbines, hydraulics of turbines, cavitation in turbine, efficiency of pumped storage plants.

Electrical load on hydro turbines:

Load curve, Load factor, power factor, capacity factor, utilization factor, Diversity factor, Load duration curve, Firm power, Secondary power, Prediction of load

Water conveyance system:

Intakes, location and types, losses in intakes, air entrainment at intake, inlet aeration, fore bay, canals, Tunnels and Penstocks, classification of penstocks, design criteria of penstock, economical diameter of penstock, Anchor blocks, Conduit valves, types of valves, bends and manifolds, Water hammer, channel surges, surge tanks types and design consideration.

Planning of power house:

Powerhouse structure, location and types of underground power stations, Components of an underground power house, Advantages and limitation of underground power house. Environmental impact of hydel project

Course learning Outcomes (CLO):

Upon completion of this course, the students will be able to:

1. Analyze various processes involved in the planning and designing of hydropower projects.
2. Define and describe various types of hydropower plants
3. Understand various terms associated with running of hydro turbines
4. Describe components of underground power stations
5. Design various components of the hydropower systems.

Text Books:

1. *Varshney, R. S., Hydro Power Structures, Nem Chand Brothers, Roorkee (2001).*
2. *Modi, P N. Irrigation Water Resources and Water Power Engineering, Standard Book House (2008)*

Reference Books:

1. *Dandekar, M. M. and Sharma, K. H., Water Power Engineering, Vikas Publishing House, New Delhi. (2013).*
2. *Warnick, C C, Hydropower Engineering, Prentice-Hall (1984)*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
4.	MST	30
5.	EST	45
6.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

GENERIC ELECTIVE

UPH063 NANOSCIENCE AND NANOMATERIALS

L	T	P	Cr
3	0	0	3.0

Course Objectives:
To introduce the basic concept of Nanoscience and advanced applications of nanotechnology,

Fundamental of Nanoscience: Features of Nanosystem, Free electron theory and its features, Idea of band structures, Density of states in bands, Variation of density of state and band gap with size of crystal,
Quantum Size Effect: Concepts of quantum effects, Schrodinger time independent and time dependent equation, Electron confinement in one-dimensional well and three-dimensional infinite square well, Idea of quantum well structure, Quantum dots and quantum wires,
Nano Materials: Classification of Nano Materials their properties, Basic concept relevant to application, Fullerenes, Nanotubes and nano-wires, Thin films chemical sensors, Gas sensors, Vapour sensors and Bio sensors,
Synthesis and processing: Sol-gel process, Cluster beam evaporation, Ion beam deposition, Chemical bath deposition with capping techniques and ball milling, Cluster assembly and mechanical attrition, Sputtering method, Thermal evaporation, Laser method,
Characterization: Determination of particle size, XRD technique, Photo luminescence, Electron microscopy, Raman spectroscopy, STEM, AFM,
Applications: Photonic crystals, Smart materials, Fuel and solar cells, Opto-electronic devices

Course outcomes:
Upon completion of the course, Students will be able to
1. discriminate between bulk and nano materials,
2. establish the size and shape dependence of Materials' properties,
3. correlate 'quantum confinement' and 'quantum size effect' with physical and chemical properties of nanomaterials,
4. uses top-down and bottom-up methods to synthesize nanoparticles and control their size and shape
5. characterize nanomaterials with various physico-chemical characterization tools and use them in development of modern technologies

Recommended Books:

1. *Booker, R., Boysen, E., Nanotechnology, Wiley India Pvt, Ltd, (2008)*
2. *Rogers, B., Pennathur, S., Adams, J., Nanotechnology, CRS Press (2007)*
3. *Bandyopadhyay, A,K., Nano Materials, New Age Int,, (2007)*

4. *Niemeyer, C. N., and Mirkin, C, A., Nanobiotechnology: Concepts, Applications and Perspectives, Wiley VCH, Weinhein, Germany (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UEN004 TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT

L	T	P	Cr
3	0	0	3.0

Course Objectives: To provide acquaintance with modern cleaner production processes and emerging energy technologies; and to facilitate understanding the need and application of green and renewable technologies for sustainable development of the Industry/society

Course Contents:

Concepts of Sustainability and Industrial Processes: Industrialization and sustainable development; Cleaner production (CP) in achieving sustainability; Source reduction techniques - Raw material substitution; Process modification and equipment optimization; Product design or modification; Reuse and recycling strategies; Resources and by-product recovery from wastes; Treatment and disposal; CDM and Pollution prevention programs; Good housekeeping; CP audits,

Green Design: Green buildings - benefits and challenges; public policies and market-driven initiatives; Effective green specifications; Energy efficient design; Passive solar design; Green power; Green materials and Leadership in Energy and Environmental Design (LEED)

Renewable and Emerging Energy Technologies: Introduction to renewable energy technologies- Solar; wind; tidal; biomass; hydropower; geothermal energy technologies; Emerging concepts; Biomolecules and energy; Fuel cells; Fourth generation energy systems,

Course Learning Outcomes (CLOs):

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

1. comprehend basic concepts in source reduction, waste treatment and management
2. Identify and plan cleaner production flow charts/processes for specific industrial sectors
3. examine and evaluate present and future advancements in emerging and renewable energy technologies

Recommended Books

1. *Kirkwood, R,C, and Longley, A,J, (Eds,), Clean Technology and the Environment, Chapman & Hall, London (1995),*
2. *World Bank Group; Pollution Prevention and Abatement Handbook – Towards Cleaner Production, World Bank and UNEP; Washington DC (1998),*
3. *Modak, P,, Visvanathan, C, and Parasnis, M,, Cleaner Production Audit, Course Material on Cleaner Production and Waste Minimization; United Nations Industrial Development Organization (UNIDP) (1995),*
4. *Rao, S, and Parulekar, B,B,, Energy Technology: Non-conventional; Renewable and Conventional; Khanna Pub,(2005) 3rd Ed,*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UHU009 INTRODUCTION TO COGNITIVE SCIENCE

L	T	P	Cr
3	0	0	3.0

Course Objectives: This course provides an introduction to the study of intelligence, mind and brain from an interdisciplinary perspective, It encompasses the contemporary views of how the mind works, the nature of reason, and how thought processes are reflected in the language we use, Central to the course is the modern computational theory of mind and it specifies the underlying mechanisms through which the brain processes language, thinks thoughts, and develops consciousness,

Course Contents;

Overview of Cognitive Science: Newell's big question, Constituent disciplines, Interdisciplinary approach, Unity and diversity of cognitive science,

Philosophy: Philosophy of Mind, Cartesian dualism Nativism vs, empiricism, Mind-body problem, Functionalism, Turing Test, Modularity of mind, Consciousness, Phineas Gage, Physicalism.

Psychology: Behaviorism vs, cognitive psychology, The cognitive revolution in psychology, Hardware/software distinction , Perception and psychophysics, Visual cognition, Temporal dynamics of visual perception, Pattern recognition, David Marr's computational theory of vision, Learning and memory, Theories of learning, Multiple memory systems, Working Memory and Executive Control, Memory span, Dissociations of short- and long-term memory, Baddeley's working memory model.

Linguistics: Components of a grammar, Chomsky, Phrases and constituents, Productivity, Generative grammars, Compositional syntax, Productivity by recursion, Surface- and deep structures, Referential theory of meaning, Compositional semantics, Semantics, Language acquisition, Language and thought.

Neuroscience: Brain anatomy, Hierarchical functional organization, Decorticate animals, Neuroimaging, Neurophysiology,Neuron doctrine, Ion channels, Action potentials, Synaptic transmission, Synaptic plasticity, Biological basis of learning, Brain damage, Amnesia, Aphasia, Agnosia, Parallel Distributed Processing(PDP), Computational cognitive neuroscience, The appeal of the PDP approach, Biological Basis of Learning, Cajal's synaptic plasticity hypothesis, Long-term potentiation (LTP) and depotentiation (LTD), NMDA receptors and their role in LTP, Synaptic consolidation, Vertical integration, The Problem of representation, Shannon's information theory.

Artificial Intelligence: Turing machines, Physical symbol systems, Symbols and Search Connectionism, Machine Learning,**,** Weak versus strong AI, Subfields, applications, and recent trends in AI, Turing Test revisited, SHRDLU, Heuristic search, General Problem Solver (GPS), Means-ends analysis.

Cognitive architectures: Tripartite architecture, Integration, ACT-R Architecture Modularity.

CourseLearningOutcomes (CLOs):

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

1. Identify cognitive science as an interdisciplinary paradigm of study of cross-cutting areas such as Philosophy, Psychology, Neuroscience, Linguistics, Anthropology, and Artificial Intelligence.
2. Explain various processes of the mind such as memory and attention, as well as representational modelling techniques that are used to build computational models of mental processes;
3. Acquire basic knowledge of neural networks, linguistic formalism, computing theory, and the brain.
4. Apply basic Artificial Intelligence techniques to solve simple problems.

Recommended Books

1. *Bermúdez, J.L., Cognitive Science: An Introduction to the Science of the Mind (2nd Ed,), Cambridge, UK: Cambridge (2014).*
2. *Friedenberg ,J,D, and Silverman,G, Cognitive Science: An Introduction To The Study Of Mind, Sage Publications:, London* (2014)
3. *Thagard, P., Mind: An introduction to Cognitive Science, MIT Press, (2005)*
4. *Thagard, P., (1998) Mind Readings: Introductory Selections on Cognitive Science, MIT Press, Cambridge, Mass,*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UHU008 INTRODUCTION TO CORPORATE FINANCE

L	T	P	Cr
3	0	0	3.0

Course Objective:
This course aims to provide the students with the fundamental concepts, principles and approaches of corporate finance, enable the students to apply relevant principles and approaches in solving problems of corporate finance and help the students improve their overall capacities.

Course Content:
Introduction to corporate finance: Finance and corporate finance. Forms of business organizations, basic types of financial management decisions, the goal of financial management, the agency problem; the role of the financial manager; basic types of financial management decisions.
Financial statements analysis: Balance sheet, income statement, cash flow, fund flow financial statement analysis Computing and interpreting financial ratios; conducting trend analysis and Du Pont analysis.
The time value of money: Time value of money, future value and compounding, present value and discounting, uneven cash flow and annuity, discounted cash flow valuation.
Risk and return: Introduction to systematic and unsystematic risks, computation of risk and return, security market line, capital asset pricing model.
Long-term financial planning & Financial Decisions: Various sources of long term financing, the elements and role of financial planning, financial planning model, percentage of sales approach, external financing needed. Cost of capital, financial leverage, operating leverage. Capital structure, theories of capital structure net income, net operating income & M&M proposition I and II.
Short-term financial planning and management: Working capital, operating cycle, cash cycle, cash budget, short-term financial policy, cash management, inventory management, credit management.
Capital budgeting : Concepts and procedures of capital budgeting, investment criteria (net present value, payback, discounted payback, average accounting return, internal rate of return, profitability index), incremental cash flows, scenario analysis, sensitivity analysis, break-even analysis,
Dividend policy: Dividend, dividend policy, Various models of dividend policy (Residual approach, Walter model, Gordon Model, M&M, Determinants of dividend policy.
Security valuation: Bond features, bond valuation, bond yields, bond risks, stock features, common stock valuation, and dividend discount & dividend growth models. Common stock yields, preferred stock valuation.

Recommended Books:

1. *Brealey, R. A., Myers. S.C., Allen, F.,Principles of Corporate Finance (9th edition), The McGraw-Hill, London, (2006).*

2. *Ehrhardt, M.C., Brigham, E.F., Financial Management: Theory and Practice (10th edition) South Western-Cengage, New York (2011)*
3. *Van Horne, J.C., Wachowicz, J.M., Kuhlemeyer, G.A., 2005, Fundamentals of Financial Management, Pearson, Vancouver (2010)*
4. *Pandey, I. M., Financial management, Vikas Publishing House Pvt. Ltd., Noida (2011)*
5. *Elton, E.J. and Gruber, M.J., Modern Portfolio Theory and Investment Analysis, (7th Edition), John Wiley and Sons, New York (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UMA062 GRAPH THEORY AND APPLICATIONS

L	T	P	Cr
3	0	0	3.0

Course Objective:
The objective of the course is to introduce students with the fundamental concepts in graph Theory, with a sense of some its modern applications. They will be able to use these methods in subsequent courses in the computer, electrical and other engineering,

Introduction: Graph, Finite and infinite graph, incidence and degree, Isolated vertex, Pendent vertex and null graph, Isomorphism, Sub graph, Walks, Paths and circuits, Euler circuit and path, Hamilton path and circuit, Euler formula, Homeomorphic graph, Bipartite graph, Edge connectivity, Computer representation of graph, Digraph.
Tree and Fundamental Circuits: Tree, Distance and center in a tree, Binary tree, Spanning tree, Finding all spanning tree of a graph, Minimum spanning tree.
Graph and Tree Algorithms: Shortest path algorithms, Shortest path between all pairs of vertices, Depth first search and breadth first of a graph, Huffman coding, Cuts set and cut vertices, Warshall's algorithm, topological sorting.
Planar and Dual Graph: Planner graph, Kuratowski's theorem, Representation of planar graph, five-color theorem, Geometric dual.
Coloring of Graphs: Chromatic number, Vertex coloring, Edge coloring, Chromatic partitioning, Chromatic polynomial, covering.
Application of Graphs and Trees: Konigsberg bridge problem, Utilities problem, Electrical network problem, Seating problem, Chinese postman problem, Shortest path problem, Job sequence problem, Travelling salesman problem, Ranking the participant in a tournament, Graph in switching and coding theory, Time table and exam scheduling, Applications of tree and graph in computer science.

Course Learning Outcomes:
Upon completion of the course, the students will be able to:

1) understand the basic concepts of graphs, directed graphs, and weighted graphs and able to present a graph by matrices.
2) understand the properties of trees and able to find a minimal spanning tree for a given weighted graph.
3) understandEulerian and Hamiltonian graphs.
4) apply shortest path algorithm to solve Chinese Postman Problem .
5) apply the knowledge of graphs to solve the real life problem.

Recommended Books

1. *Deo, N., Graph Theory with Application to Engineering with Computer Science, PHI, New Delhi (2007)*

2. *West, D. B., Introduction to Graph Theory, Pearson Education, London (2008)*
3. *Bondy, J. A. and Murty, U.S.R., Graph Theory with Applications, North Holland Publication, London (2000)*
4. *Rosen, K. H., Discrete Mathematics and its Applications, Tata-McGraw Hill, New Delhi (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UMA061 ADVANCED NUMERICAL METHODS

L	T	P	Cr
3	0	0	3.0

Course Objective:
The main objective of this course is to motivate the students to understand and learn various advanced numerical techniques to solve mathematical problems governing various engineering and physical problems.

Non-Linear Equations: Methods for multiple roots, Muller's, Iteration and Newton-Raphson method for non-linear system of equations and Newton-Raphson method for complex roots.
Polynomial Equations: Descartes' rule of sign, Birge-vieta, Giraffe's methods.
System of Linear Equations: Cholesky and Partition methods, SOR method with optimal relaxation parameters.
Eigen-Values and Eigen-Vectors: Similarity transformations, Gerschgorin's bound(s) on eigenvalues, Given's and Rutishauser methods.
Interpolation and Approximation: Cubic and B – Spline and bivariate interpolation, Least squares approximations, Gram-Schmidt orthogonalisation process and approximation by orthogonal polynomial, Legendre and Chebyshev polynomials and approximation.
Differentiation and Integration: Differentiation and integration using cubic splines, Romberg integration and multiple integrals.
Ordinary differential Equations: Milne's, Adams-Moulton and Adam's Bashforth methods with their convergence and stability, Shooting and finite difference methods for second order boundary value problems.

Course Learning Outcomes:
Upon completion of this course, the students will be able to**:**

1) find multiple roots of equation and apply Newton -Raphson's method to obtain complex roots as well solution of system of non - linear equations.
2) learn how to obtain numerical solution of polynomial equations using Birge - Vitae and Giraffe's methods.
3) applyCholesky, Partition and SOR methods to solve system of linear equations.
4) understand how to approximate the functions using Spline, B- Spline, least square .approximations
5) learn how to solve definite integrals by using cubic spline, Romberg and initial value problems and boundary value problems numerically.

Recommended Books

1) *Gerald, C.F. and Wheatley, P.O., Applied Numerical Analysis, Pearson Education (2008) 7th ed.*
2) *Gupta, S.R., Elements of Numerical Analysis, MacMillan India (2009).*
1) *Atkinson, K.E., An introduction to Numerical Analysis, John Wiley (2004) 2nd ed.*

2) *S.D. Conte, S.D. and Carl D. Boor, Elementary Numerical Analysis: An Algorithmic Approach, Tata McGraw Hill (2005).*
3) *Jain M. K., Iyengar. S.R.K. and Jain, R.K. Numerical Methods for Scientific and Engineering Computation, New Age International (2008) 5th ed.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UHU006 INTRODUCTORY COURSE IN FRENCH

L	T	P	Cr
3	0	0	3.0

Course Objectives:

The objectives of the course is to introduce to the students:

1. The basics of French language to the students. It assumes that the students have minimal or no prior knowledge of the language.
2. To help them acquire skills in writing and speaking in French, comprehending written and spoken French.
3. The students are trained in order to introduce themselves and others, to carry out short conversation, to ask for simple information, to understand and write short and simple messages, to interact in a basic way.
4. The main focus of the students will be on real life language use, integration of French and francophone culture, & basic phrases aimed at the satisfaction of needs of concrete type.
5. During class time the students are expected to engage in group & pair work.

Course Contents:

Communicative skills: Greetings and Its Usage, Asking for and giving personal information, How to ask and answer questions, How to talk over the phone, Exchange simple information on preference, feelings etc. Invite, accept, or refuse invitation, Fix an appointment, Describe the weather, Ask for/give explanations, Describe a person, an object, an event, a place.

Grammar : Pronouns: Pronom sujets (Je/ Tu/Il/Elle/Nous/Vous/Ils/Elles), Nouns: Genders, Articles: Definite article and Indefinite articles, Verbs: Regular verbs (-er, -irending) Irregularverbs (-reending), Auxiliaryverbs (avoir, être, aller). Adjective: Description, Adjective possessive, Simple Negation, Tense: Present, Future, Questions, Singular & plural.

Vocabulary: Countries and Nationalities, Professions, Numbers (ordinal, cardinal), Colours, Food and drinks, Days of the week, Months, Family, Places.

Phonetics: The course develops the ability, to pronounce words, say sentences, questions and give orders using the right accent and intonation. To express surprise, doubt, fear, and all positive or negative feelings using the right intonation.To distinguish voiced and unvoiced consonants.To distinguish between vowel sounds.

Course Outcomes:

Upon the completion of the course:

1. The students begin to communicate in simple everyday situations acquiring basic grammatical structure and vocabulary.
2. The course develops oral and reading comprehension skills as well as speaking and writing.
3. Students can demonstrate understanding of simple information in a variety of authentic materials such as posters, advertisement, signs etc.
4. Discuss different professions, courses and areas of specialisation.
5. Write simple messages, letters, composition and dialogues. Complete simple forms and documents.

6. Express feelings, preferences, wishes and opinions and display basic awareness of francophone studies.
7. Units on pronunciation and spelling expose students to the different sounds in the French language and how they are transcribed.

Recommended Books :

1. *Alter ego-1 : Méthode de français by Annie Berthet, Catherine Hugot, Véronique M. Kizirion, Beatrix Sampsonis, Monique Waendendries, Editions Hachette français langue étrangère.*
2. *Connexions-1 : Méthode de français by Régine Mérieux, Yves Loiseau, Editions Didier*
3. *Version Originale-1: Méthode de français by Monique Denyer, AgustinGarmendia.*
4. *Marie-Laure Lions-Olivieri, Editions Maison des Langues, Paris 2009*
5. *Latitudes-1 : Méthode de français by Régine Mérieux, Yves Loiseau, Editions Didier*
6. *Campus-1 : Méthode de français by Jacky Girardet, Jacques Pécheur, Editions CLE International.*
7. *Echo-1 : Méthode de français by J. Girardet, J. Pécheur, Editions CLE International.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UBTxxx BIOLOGY FOR ENGINEERS

L	T	P	Cr
3	0	0	3.0

Course Objective: To learn about living world and basic functioning of biological systems. The course encompasses understanding of origin of life, its evolution and some of its central characteristics. It also aims to familiarize engineering students to some of the intricate biological phenomena and mechanisms.

Detailed Contents:

Characteristics of life: Living versus non-living organisms, origin of life, theory of evolution, diversity of life, classification of life into animals, plants, fungi, protists, archea and bacteria. Phylogenetics and its relationship with evolution.

Introduction to biological systems: Cell as basic unit of life, cellular organelles and their functions, important biomacromolecules (carbohydrates, lipids, proteins and nucleic acids) and their properties.

Cell membrane: Membrane structure, selective permeability, transport across cell membrane, active and passive transport, membrane proteins, type of transport proteins, channels and pumps, examples of membrane transport in cell physiology.

Classical and molecular genetics: Heredity and laws of genetics, genetic material and genetic information, Structure and properties of DNA, central dogma, replication of genetic information, universal codon system, encoding of genetic information via transcription and translation.

Course Learning Outcomes (CLOs):

After completion of this course the students will be able to:

1. Describe living-systems and differentiate them from non-living systems
2. Explain the theory of evolution and apply it non-living world
3. Apply properties of nucleic acids in molecular recognition based diagnostics
4. Familiarized with various transport mechanisms across cell membranes
5. Explain how genetic information is stored, replicated and encoded in living organisms.

Recommended Books:

1. *Nelson, D.L., Cox, M.M., Lehninger: Principles of Biochemistry, WH Freeman (2008) 5th ed.*
2. *Dhami, P.S., Srivastava, H.N. Chopra, G., A Textbook of Biology, Pradeep Publications (2008).*
3. *Das, H.K., Textbook of Biotechnology, John Wiley & Sons (2004) 3rd Edition.*
4. *Gardner, E.J., Simmons, M., Peter, S.D., Principles of Genetics, John Wiley & Sons (2008)*
5. *Albert, B., Essential Cell Biology, Taylor & Francis, London (2009)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UCS001 INTRODUCTION TO CYBER SECURITY

L	T	P	Cr
3	0	0	3.0

Course Objectives: In this course, the student will learn about the essential building blocks and basic concepts around cyber security such as Confidentiality, Integrity, Availability, Authentication, Authorization, Vulnerability, Threat and Risk and so on.

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography
Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures
Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks
Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit
Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management
Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS
Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed
Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster
Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics
Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

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

1. Understand the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection
2. Appreciate the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure
3. Understand the nature of secure software development and operating systems
4. Recognize the role security management plays in cyber security defense and legal and social issues at play in developing solutions.

Recommended Books:

1. *Pfleeger, C.P., Security in Computing, Prentice Hall, 5th edition (2010)*
2. *Schneier, B., Applied Cryptography, Second Edition, John Wiley & Sons (1996)*
3. *Rhodes-Ousley, M., Information Security: The Complete Reference, Second Edition, Information Security Management: Concepts and Practice. New York, McGraw-Hill, (2013).*
4. *Whitman, M.E. and Herbert J. M., Roadmap to Information Security for IT and Infosec Managers, Course Technology, Boston, MA (2011).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UHU007 EMPLOYABILITY DEVELOPMENT SKILLS

L	T	P	Cr
0	3	3	3.0

Course Objectives:
This course aims to sensitize students with the gamut of skills which facilitate them to enhance their employability quotient and do well in the professional space. These skills are imperative for students to establish a stronger connect with the environment in which they operate. An understanding of these skills will enable students to manage the placement challenges more effectively.

Course Contents:
Emotional Intelligence: Understanding Emotional Intelligence (EI); Daniel Goleman's EI Model: Self Awareness, Self-Regulation, Internal Motivation, Empathy, Social Skills; Application of EI during Group Discussions & Personal Interview; Application of EI in personal life, student life and at the workplace
Team Dynamics & Leadership: Understanding the challenges of working within a team format in today's complex organizational environments; Stages of team formation; Appreciating forces that influence the direction of a team's behaviour and performance; Cross-functional teams; Conflict in Teams- leveraging differences to create opportunity Leadership in the team setting & energizing team efforts; Situational leadership; Application of team dynamics & collaboration in Group Discussions; Application of team dynamics at the workplace
Complex Problem Solving: Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions; Understanding a working model for complex problem solving - framing the problem, diagnosing the problem, identifying solutions & executing the solutions; Appreciation of complex problem solving at the workplace through case studies
Lateral Thinking: Understanding lateral thinking &appreciatingthedifferencebetween vertical & lateral thinking, and between convergent & divergent thinking; Understanding brain storming & mind-maps; Solving of problems by an indirect and creative approach, typically through viewing the problem in a new and unusual light; Application of lateral thinking during Group Discussions & Personal Interviews; Application of lateral thinking at the workplace
Persuasion: Role of persuasion in communication; Application of ethos-pathos-logos; Using persuasive strategies to connect with individuals & teams to create competitive advantage
Quantitative Reasoning: Thinking critically and applying basic mathematics skills to interpret data, draw conclusions, and solve problems; developing proficiency in numerical reasoning; Application of quantitative reasoning in aptitude tests
Verbal Reasoning: Understanding and reasoning using concepts framed in words; Critical verbal reasoning; Reading Comprehension; Application of verbal reasoning in aptitude tests

Group Discussion (GD): Illustrating the do's and don'ts in Group Discussions; Specific thrust on types of GD topics; GD evaluation parameters; Understanding the challenge in a case discussion; SPACER model

Personal Interview (PI): Interview do's and don'ts; PI evaluation parameters; The art of introduction; Managing bouncer questions; Leading the panel in a PI

Course Learning Outcomes (CLOs): The students will be able to

1. Appreciate the various skills required for professional & personal success.
2. Bridge the gap between current and expected performance benchmarks.
3. Competently manage the challenges related to campus placements and perform to their utmost potential.

Recommended Books:

1. *Harvard Business Essentials; Creating Teams with an Edge; Harvard Business School Press (2004)*
2. *Edward de B., Six Thinking Hats; Penguin Life (2016)*
3. *Daniel, G., Working with Emotional Intelligence; Bantam Books (2000)*
4. *Aggarwal, R.S., Quantitative Aptitude for Competitive Examinations; S Chand (2017)*
5. *Agarwal, A., An expert guide to problem solving: with practical examples; CreateSpace Independent Publishing Platform (2016)*
6. *William, D., The Logical Thinking process; American Society for Quality (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55