MID-WEST UNIVERSITY

FACULTY OF ENGINEERING

Surkhet, Nepal

CURRICULUM OF BACHELOR IN HYDROPOWER ENGINEERING

2021

Contents

GENERAL POLICY

ON

BACHELOR OF HYDROPOWER ENGINEERING PROGRAM OF MID-WEST UNIVERSITY

1. Introduction

Mid-West University (MU) is offering undergraduate (Bachelor level) program in Hydropower Engineering with the objective of producing high-level technical manpower as per the nation's need and equipping with capacity to undertake any kinds of Hydropower Engineering works using the latest technologies. Basic information regarding the general policy of Mid-West University related to Bachelor of Hydropower Engineering Program is stated in below sections.

2. Title

The title of the program is Bachelor of Hydropower Engineering (B.E. Hydropower)

3. Objective

The objective of the Hydropower Engineering Program at Mid-West University is to prepare students with appropriate technical & analytical knowledge and skills to produce high quality hydropower engineers and researchers.

4. Duration of the Course

The total duration of the course is 4 years (eight semesters). Each year consists of two semesters.

5. Medium of Instruction and Examination

The medium of instruction and examination of Hydropower Engineering Program shall be in English.

6. Entry Requirement for New Students

The entry requirement for students in B.E. hydropower is Intermediate in Science (I.Sc.), or Higher Secondary level (10+2) or Diploma in Engineering or Architecture or equivalent from a recognized institution with at least a second division marks at their respective Intermediate level. Besides the basic academic requirement, the candidate must have passed entrance examination conducted by the University.

7. Admission Procedure

The entrance test application form and the information brochure shall be provided on request at the Dean's Office (MU) or at the concerned college. The concerned college scrutinizes the applications. The eligible candidates are informed to appear in the entrance test. The exact date for the entrance test is communicated to the applicants by the college. The candidates shall be admitted on merit basis.

The college may also hold interviews for the candidates before their final selection for admission. Eligible foreign national students may be admitted against limited seats on the basis of an interview to be conducted by the college.

The candidates, who are given provisional admission pending submission of the qualifying certificates, are required to submit all necessary documents within a week of the beginning of regular classes. Otherwise, the admission will be annulled.

8. The Credit System

Each course is assigned a certain number of credits depending generally upon its lecture, tutorial and practical work hours in a week. In theory subjects, one lecture hour per week is assigned one credit as a general rule.

9. Academic Schedule

The academic session of the University consists of two semesters per year. The Fall semester starts in November and the Spring Semester starts in May. For the Bachelor's program in engineering, student admission may commence either in the Fall semester or in the Spring semester, as approved by the University. Mid-West University publishes its yearly academic calendar. The affiliated colleges are required to follow the calendar.

10. Student Evaluation

The students' academic performance during a semester is evaluated using the system of continuous assessment (evaluation of internal assessment plus the final examination). The college and the University conduct the internal assessment and the final examinations, respectively. Each course shall have internal assessment marks of 50% evaluated by the assigned teacher. Generally, each course will have a written semester examination of 50% marks at the end of each semester.

In the Practical courses, except subject surveying and engineering geology, final examination will not be conducted and the internal assessment marks shall be awarded on the basis of continual assessment.

Grading System

The grade (marks) awarded to a student in a course is based on his/her consolidated performance in internal assessments and final examinations. The letter grade in any particular subject is an indication of a student's relative performance in that course. The pattern of grading is as follows:

Letter	Range	Grade	Grade Point Description
A	85-100	4.0	Outstanding
A-	80-84	3.67	Distinction
B	75-79	3.33	Excellent
B-	70-74	3.00	Very Good
C	65-69	2.50	Good
C-	60-64	2.00	Average
D	55-59	1.50	Fair
D-	50-54	1	Satisfactory
F	Below 50	0	Failing

Only in very rare and unusual circumstances, if a student cannot finish all the required work for the course, he/she may be awarded an incomplete grade "I". If all the required work is not completed within the following semester, the grade of I will automatically be converted to an "F". A student receiving an I grade do not need to register for that subject in the following semester to complete the required works.

The performance of a student in a semester shall be evaluated in terms of the Semester Grade Point Average (SGPA) which is the grade point average for the semester. The cumulative grade point average (CGPA) is the grade point average for all completed semesters.

SGPA = total honor points earned in a semester / total number of credits registered in a semester
CGPA = total honor points earned / total number of credits completed

11. Attendance Requirement

The students must attend every lecture, tutorial and practical classes. However, to accommodate for sickness and other contingencies, the attendance requirement shall be a minimum of 80% of the classes actually held. If a student fails to attend 80% of the classes in any particular subject, he/she shall not be allowed to take the final examination in that subject. If a student is continuously absent in the college for more than four weeks without notifying the Campus, his/her name will be removed from the college registration.

12. Normal and Maximum Duration of Stay at the College

The normal duration for completing the Bachelor of Hydropower Engineering program at the university will be four years. The maximum duration for the completion of the requirements shall be the normal duration plus four years.

13. Course Registration

The academic record of a student is maintained in terms of the courses for which he/she registers in any semester, and the grades he/she obtains in those courses. Registration for courses is done at the beginning of each semester. Since registration is a very important procedural part of the credit system, it is absolutely essential that all students present themselves at the campus. In case of illness or any exceptional circumstance during the registration period, he/she must inform the Campus.

14. Repeating a Course

A course may be taken only once for a grade, except when a student receives a D or F grade. Since passing of all core courses individually is a degree requirement, the student must retake the failing core course when offered and must successfully complete the course. Retaking a course in which a student has earned a D grade is optional. However, a student cannot retake more than two courses in which he/she has received D grade. The grade earned on the retake will be substituted for the grade earned first time the course was taken.

15. Transfer of Credit Hours

A maximum of 15 credit hours of course work completed in an equivalent program of a recognized institution may be transferred for credit. For transfer of credit, a student must have received a grade of B or better in the respective course. Courses taken earlier than five years from the time of transfer may not be accepted for transfer of credit.

The concerned Subject Committee of the University will make an evaluation of the applicant for transfer of credit. The awarding of transferred credit will be based on the applicant's score in the college or University, which he/she attended previously.

16. Course Coding for Hydropower Engineering

Each course is identified by two letters followed by a three-digit number. The two letters indicate the subject area (e.g., SH for Science & Humanities, EL for Electrical Engineering, EX for Electronics & communication Engineering, ME for Mechanical Engineering, AR for Architectural Engineering, CO for Computer Engineering, CE for Civil Engineering, HE for Hydropower Engineering, MS for Management Science etc.). The first digit of each number indicates the 4-year bachelor level, second digit indicates semester (1 for first, 2 for second and so on 8 for eighth semester) and last or third digit indicates course sequence.

Example,
SH411 is the code for the subject Engineering Mathematics I which is offered in the Bachelor first year, where Science and Humanities is the subject area.

17. Elective Courses

The curriculum is oriented to have intensive study in the field of interest with course registration flexibility at least for three courses, but in future, course registration flexibility shall be increased to more number of courses.

18. Award of Degree

The Mid-West University awards Bachelor of Hydropower Engineering degree upon completion of all requirements as prescribed in the curriculum. MU awards grades as explained in the curriculum on the basis of individual student's relative performance. The minimum credit hours needed for B.E. Hydropower Engineering is 150 Credit hours.

Cumulative Grade Point Average (CGPA) for the degree shall be awarded upon completion of all requirements.

19. Scrutinizing of Final Examination Paper

Students may apply for re-totaling or rechecking of their grades as per University rule, upon payment of prescribed fee.

20. Final Examination

The MU conducts final examination at the end of each semester. The procedure of final examination conduction will be as per the examination rules of the MU.

Note: The provisions of this document are not to be regarded as a binding contract between the University and the students. The University reserves the right to change any provisions requirements contained in this document at any time, without pre-notification, within the students' term of residence.

BACHELOR IN HYDROPOWER ENGINEERING
COURSE STRUCTURE

Year/Part: I/I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	SH411	Engineering Mathematics I	3	3	2	-	5
2	HE411	Applied Mechanics I (Statics)	3	3	2	-	5
3	SH412	Engineering Chemistry	3	3	1	2	6
4	ME411	Engineering Drawing I	2	1	-	3	4
5	ME412	Workshop Technology	1	1	-	2	3
6	HE412	Construction Materials	3	3	-	2	5
7	CO411	Basic Computer Concept and Programming	3	3	1	2	6
Total			**18**	**17**	**6**	11	**34**

Year/Part: I/II

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	SH421	Engineering Mathematics II	3	3	2	-	5
2	HE421	Applied Mechanics II (Dynamics)	3	3	2	-	5
3	SH422	Engineering Physics	3	3	2	2	7
4	ME421	Fundamental of Thermodynamics and Heat Transfer	3	3	1	1.5	5.5

5	ME422	Engineering Drawing II	2	1	-	3	4
6	EX421	Basic Electronics Engineering	3	3	1	1.5	5.5
7	HE422	Basics of Water Resource	3	3	1	1	5
Total			**20**	**19**	**9**	**9**	**37**

Year/Part: II/I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	SH431	Engineering Mathematics III	3	3	2	-	5
2	EL431	Fundamental of Electrical Engineering	3	3	1	2	6
3	HE431	Strength of Materials	3	3	1	1	5
4	HE432	Fluid Mechanics	3	3	2	1	6
5	HE433	Surveying I	3	3	1	3	7
6	HE434	Engineering Geology	3	3	1	1	5
7	SH432	Communication English	3	3	1	2	6
Total			**21**	**21**	**9**	**10**	**40**

Year/Part: II/II

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	HE441	Theory of structure I	3	3	1	1	5
2	HE442	Surveying II	3	3	1	3	7
3	HE443	Hydraulics	4	4	2	1	7
4	SH441	Probability and Statistics	3	3	2		5
5	HE444	Engineering Hydrology	3	3	2	1	6
6	HE445	Soil Mechanics	3	3	1	1	5
7	HE446	Concrete Technology and Masonry Structures	3	3	1	1	5
Total			22	22	10	8	40

Year/Part: III/I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	HE451	Theory of Structures II	3	3	2	1	6
2	HE452	Fundamental of Hydropower	3	3	1	1	5
3	HE453	Computational Techniques	3	3	2	-	5
4	HE454	Foundation Engineering	3	3	2	-	5
5	HE455	Geographical Information System and Remote sensing	3	3	1	3	7
6	HE456	Road Engineering	3	3	1	1	5
7	HE457	Electro-mechanical Equipment	3	3	1	3	7
8	HE458	Survey Camp	1	1	-	2	3
Total			**22**	**22**	**10**	**11**	**43**

Year/Part: III/II

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	HE461	Design of steel Structures	3	3	2	-	5
2	HE462	Design of Hydraulic Structure	4	4	2	-	6
3	HE463	Pumps and Turbines	3	3	2	-	5
4	HE464	Power System Apparatus	3	3	1	3	7

5	HE465	Engineering Economics	3	3	1	-	4
6	HE466	Rock Mechanics and Tunneling	3	3	1	1	5
7	HE46*	Elective I	3	3	-	-	3
Total			**22**	**22**	**9**	**4**	**35**

Year/Part: IV/I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	HE471	Hydropower Project- I	2	1	-	6	7
2	HE472	Design of RCC Structures	4	4	2	1	7
3	MS471	Construction Project Management	3	3	-	-	3
4	HE473	Estimating and Valuation	3	3	2	-	5
5	HE474	Engineering Ethics and Entrepreneurship	2	3	-	-	
6	HE47*	Elective II	3	3	-	-	3
7	HE47*	Elective III	3	3	-	-	3
Total			**20**	**17**	**4**	**7**	**28**

Year/Part: IV/II

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	HE481	Hydropower Engineering Project II	3	1	-	6	7
2	HE482	Internship	2		3 Month		-
		Total	**5**	**1**	**-**	**6**	**7**

Elective I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	HE467	Applied Hydrology	3	3	1	1	5
2	HE468	Irrigation and Drainage Engineering	3	3	1	1	5
3	HE469	Environmental Pollution and Management	3	3	1	1	5

Elective II/Elective III

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	HE475	Modelling of Water Resources	3	3	1	1	5
2	HE476	Water Supply and Sanitation Engineering	3	3	1	1	5
3	HE477	Building Technology	3	3	1	1	5

B.E. (HYDROPOWER) FIRST YEAR DETAIL SYLLABUS

(FIRST SEMESTER)

ENGINEERING MATHEMATICS I

COURSE CODE: SH411

Year: I
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50		50		100	

Course Objectives: The basic objective of the course is to provide the students a sound knowledge of calculus, analytic geometry and other related topics.

1. Limit and Continuity (3 hours)
   - 1.1. Limit of a function with examples
   - 1.2. Infinity as a limit
   - 1.3. Continuity of a function with their properties

2. Derivatives and their Applications (14 hours)
   - 2.1. Introduction
   - 2.2. Higher order derivatives (Leibnitz's theorem)
   - 2.3. Mean value theorem: Rolle's theorem, Lagrange's mean value theorem, and Cauchy's mean value theorem (Statement only).
   - 2.4. Power series of single valued function (Taylor's series, and Maclaurin's series)
   - 2.5. Indeterminate forms; L'Hospital rule
   - 2.6. Asymptotes to Cartesian and polar curves
   - 2.7. Curvature and radius of curvature

3. Integration and its Applications (12 hours)
   - 3.1. Introduction (Basic integration formulas, Methods of integration, and standard integrals)
   - 3.2. Definite integrals and its properties
   - 3.3. Improper integrals
   - 3.4. Differentiation under integral sign
   - 3.5. Reduction formula; Beta Gama functions
   - 3.6. Application of integrals for finding areas, arc length, surface and solid of revolution in the plane for Cartesian and polar curves

4. Plane Analytic Geometry (8 hours)
   - 4.1. Transformation of coordinates: Translation and rotation
   - 4.2. Ellipse and hyperbola; Standard forms, tangent, and normal
   - 4.3. General equation of conics in Cartesian and polar forms

5. Vector Algebra (8 hours)
   - 5.1. Vector components and types of vector
   - 5.2. Vector addition and subtraction
   - 5.3. Direction Cosines and space coordinates (Cartesian cylinder, and Spherical)
   - 5.4. Scalar products and vector products
   - 5.5. Product of three and four vectors
   - 5.6. Vector equation of lines and planes

Reference books:

1. E. Kreyszig, "Advance Engineering Mathematics", Wiley, New York.
2. G.B. Thomas, and R.L. Finney, "Calculus and Analytic geometry", Addison Wesley.
3. G.D. Pant, G. S. Shrestha, "Integral Calculus and Differential Equations", Sunila Prakashan, Nepal
4. L. Prasad, "Higher Coordinate Geometry", Paramount Publication, Patna, India.
5. M. B. Singh, B. C. Bajrachrya, "Differential calculus", Sukunda Pustak Bhandar,Nepal
6. M. B. Singh, S. P. Shrestha, "A text book of Vector Analysis", Sukunda Pustak Bhandar,Nepal

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	3	4
2.	14	16
3.	12	16
4.	8	8
5.	8	6
Total	**45**	**50**

* There may be minor deviation in marks distribution.

APPLIED MEHANICS I (STATICS)

COURSE CODE: HE411

Year: I
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objectives: The basic objective of the course is to provide the students a sound knowledge of Newton's laws of motion and mechanical equilibrium so that it would be helpful for them to understand structural engineering stress analysis principles in later courses or to use basics of mechanics in their branch of engineering.

1. Introduction (2 hours)
   - 1.1. Fundamental concepts and principles
   - 1.2. Concept of particles in rigid and deformed bodies
   - 1.3. Concept of statistics and dynamics
   - 1.4. Physical meaning of equilibrium and its essence in structural application
   - 1.5. System of units

2. Statics of Particles (12 hours)
   - 2.1. Concept of forces and free body diagram
   - 2.2. Equation of equilibrium in 2D and 3D
   - 2.3. Introductions of vectors (Vector & scalar quantities, laws of vectors and their applications, units of vectors, and scalar and vector triple product)
   - 2.4. Different types of forces: Point, Surface traction and Body Forces
   - 2.5. Resolution and composition of forces: Relevant examples
   - 2.6. Principle of transmissibility and equivalent forces: Relevant examples
   - 2.7. Moments and couples: Relevant examples
   - 2.8. Resolution of a force into forces and a couple
   - 2.9. Resultant of force and moment for a system of force: Examples
   - 2.10. Introduction of friction (Definition, Types, Coefficient of friction, Angle of friction, Laws of friction)

3. Distributed Forces: Center of Gravity, Centroid and Moment of Inertia (6 hours)
   - 3.1. Concepts and calculation of centre of gravity and centroid: Examples
   - 3.2. Calculation of second moment of area /moment of inertia and radius of gyration
   - 3.3. Use of parallel and perpendicular axis theorem: Relevant examples
   - 3.4. Moment of inertia of common figures, built up section and uniform thin rod

4. Introduction of Structures (4 hours)
   - 4.1. Introduction to structures: Discrete and continuum
   - 4.2. Definition and types of beam, frame and truss
   - 4.3. Difference between mechanism and structure
   - 4.4. Concept of load estimating and support idealizations
   - 4.5. Concept of rigid joints/distribute loads in beams/frames.
   - 4.6. Concept of statically/kinematically determinate and indeterminate beams, frames, and truss: Relevant examples

5. Analysis of Beam and Frame (8 hours)
   - 5.1. External and internal forces in beam
   - 5.2. Determinacy and stability of frame
   - 5.3. Sign convention of different internal forces
   - 5.4. Calculation of axial force, shear force and bending moment for determinate beams and frames (Joint and section method)
   - 5.5. Axial force, shear force and bending moment diagrams and examples for drawing them .

6. Analysis of Trusses (6 hours)
   - 6.1. Determinacy and stability of truss
   - 6.2. Analysis of plane truss (Method of joints and sections)
   - 6.3. Introduction to space truss

7. Introduction of Kinematics and Kinetics (7 hours)
   - 7.1. Rectilinear kinematics: Continuous motion
   - 7.2. Position, velocity and acceleration of a particle and rigid body
   - 7.3. Curvilinear motion: Rectangular components with examples of particles
   - 7.4. Newton's second law of motion and momentum

7.5. Equation of motion and dynamic equilibrium
7.6. Angular momentum and rate of change
7.7. Equation of motion-rectilinear and curvilinear

Reference books:

1. A.K. Dubey, and A. Kumar, "Engineering Mechanics", New Age International Publishers, New Delhi.
2. F.P. Beer, and E.R. Johnston, "Mechanics of Engineers-Statics and Dynamics", Mc Graw-Hill, New Delhi.
3. R.C. Hibbeler, and A. Gupta, "Engineering Mechanics-Statics and Dynamics", Pearson, New Delhi.
4. R.S. Khurmi, "A Text Book of Engineering Mechanics", S. Chand & Company Ltd., New Delhi.
5. R.S.Khurmi, "Applied Mechanics and Strength of Materials", S. Chand & Company Ltd., New Delhi.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	**Hours**	**Mark Distribution***
1	2	4
2	12	12
3	6	8
4	4	4
5	8	10
6	6	8
7	7	4
Total	**45**	**50**

* There may be minor deviation in marks distribution.

ENGINEERING CHEMISTRY

COURSE CODE: SH412

Year: I
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	1	50	-	50	50	150	

Course Objectives: The objective of the course is to analyze chemical behavior of materials, water quality and environmental aspects of various elements and compounds.

1. Atomic Structure (4 hours)
   - 1.1. Bohr's theory
   - 1.2. De-Broglie's equation
   - 1.3. Heisenberg uncertainty principle
   - 1.4. Quantum number and shape of s, p, d orbital's

2. Electro-Chemistry (4 hours)
   - 2.1. Strong and weak electrolytes
   - 2.2. Electro-chemical cells
   - 2.3. Electrode potential and standard electrode potential
   - 2.4. Measurement of standard reduction potential
   - 2.5. Nernst's equation
   - 2.6. EMF of cell
   - 2.7. Electrochemical series and its application
   - 2.8. Buffer: its type and mechanism
   - 2.9. Henderson's equation for pH of buffer and related problems
   - 2.10. Corrosion and its type
   - 2.11. Factors influencing corrosion
   - 2.12. Prevention of corrosion

3. Catalyst (4 hours)
   - 3.1. Introduction
   - 3.2. Action of catalyst (catalytic promoters and catalytic poisons)
   - 3.3. Characteristics of catalyst
   - 3.4. Types of catalyst
   - 3.5. Theories of catalysis
   - 3.6. Industrial applications of catalysts

4. Environmental Chemistry (4 hours)
   - 4.1. Air pollution and pollutants
   - 4.2. Effects of air pollutants on human beings and their possible remedies
   - 4.3. Ozone depletion and its photochemistry
   - 4.4. Water pollution and pollutants (ref of surface water and pound water)
   - 4.5. Soil pollution and pollutants (effects and possible remedies)

5. Polymers and Polymerizations (6 hours)
   - 5.1. Definition and types of polymers
   - 5.2. General properties of inorganic polymers
   - 5.3. Polyphosphazines
   - 5.4. Sulphor based polymers
   - 5.5. Chalcogenide glasses
   - 5.6. Silicones
   - 5.7. Types of organic polymers
   - 5.8. Preparation and application of polyurethane, polystyrene, polyvinylchloride, Teflon and nylon
   - 5.9. Concept of bio-degradable, non-biodegradable and conducting polymers

6. Transition Elements and their Applications (5 hours)
   - 6.1. Introduction
   - 6.2. Electronic configuration
   - 6.3. Metallic character
   - 6.4. Variable valency
   - 6.5. Complex formation tendency
   - 6.6. Color formation
   - 6.7. Magnetic properties
   - 6.8. Alloy formation
   - 6.9. Applications of transition elements

7. Chemical Bonding (5 hours)
   - 7.1. Introduction
   - 7.2. Types of bond
   - 7.3. Valence bond theory of complexes
   - 7.4. Application of valence bond theory in the formation of (i) Tetrahedral complexes, (ii) Square planar complexes and (iii) Octahedral complexes
   - 7.5. Limitations of valence bond theory
   - 7.6. Hybridization
   - 7.7. General introduction of coordination compounds

8. Explosives (3 hours)
   - 8.1. Introduction
   - 8.2. Types of explosives
   - 8.3. Preparation and application of TNT, TNG, Nitrocellulose and Plastic explosives

9. Lubricants and Paints (2 hours)
   - 9.1. Introduction
   - 9.2. Function of lubricants
   - 9.3. Classification of lubricants (oils, greases and solid)
   - 9.4. Paints
   - 9.5. Types of paint
   - 9.6. Application of paints

10. Stereochemistry (4 hours)
   - 10.1. Introduction
   - 10.2. Geometrical isomerism (cis trans isomerism), Z and E concept of geometrical isomerism
   - 10.3. Optical isomerism with reference to two asymmetrical carbon center molecules

11. Organic Reactions (4 hours)
   - 11.1. Substitution reaction and its types
   - 11.2. Elimination reaction and its type
   - 11.3. Factors governing SN1, SN2, El and E2 reaction mechanism path

Reference books:

1. A. Bahl, and B.S. Bahl, "Advance Organic Chemistry", S. Chand & Company Ltd. New Delhi.
2. A. K. De, "Environmental Chemistry", New Age International Ltd., New Delhi.
3. B.S. Bahl, G.D. Tuli, and A. Bahl, "Essential of Physical Chemistry", S. Chand & Company Ltd. New Delhi.
4. B. H. Mhan, "University Chemistry", Narosa Publishing House, New Delhi.
5. G.S. Mishra, "Introduction to Polymer Chemistry", New Age International Ltd., New Delhi.
6. J. D. Lee, "Concise Environmental Chemistry", Chapman & Hall, London.
7. M. Boyd, "Organic Chemistry", Prentice-Hall of India Ltd., New Delhi.

Laboratory/Practical :(3 hours per week)

1. Compare the alkalinity of different water samples by double indicator method
2. Determine the temporary and permanent hardness of water by EDTA complexo-metric method
3. Determine residual and combined chlorine present in the chlorinated sample of water by iodometric method
4. Prepare organic polymer nylon 6,6/ Bakelite in the laboratory
5. Determine the pH of different sample of buffer solution by universal indicator method
6. Prepare inorganic complex in the laboratory
7. Construct an electrochemical cell in the laboratory and measure the electrode potential of it
8. Estimate the amount of iron present in the supplied sample of ferrous salt using standard potassium permanganate solution (redox titration)

Evaluation Scheme:

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the question will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	4	5
2	4	5
3	4	5
4	4	5
5	6	5
6	5	5
7	5	5
8	3	2
9	2	3
10	4	5
11	4	5
Total	**45**	**50**

* There may be minor deviation in marks distribution.

ENGINEERING DRAWING I

COURSE CODE: ME411
Year: I

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
1	3	-	-	50	-	50	100	

Course Objectives: The basic objective of the course is to develop sketching, lettering and drafting skills. The course alsoemphasized basic projection concepts with reference to points, lines, planes and geometrical solids.

1. Instrumental Drawing, Technical Lettering Practices, Dimensioning and Techniques (6 hours)
   - 1.1. Manual drawing equipment and its use
   - 1.2. Description of drawing instruments, auxiliary equipment and drawing materials
   - 1.3. Techniques of instrumental drawing pencil sharpening, securing paper, proper use of T- squares, Triangles, Scales dividers, Compasses, Erasing shields, French curves, and Inking pens
   - 1.4. Lettering strokes, letter proportions, use of pencils and pens, uniformity and appearance of letters, freehand techniques, inclined and vertical letters and numerals, upper and lower cases, standard English lettering forms
   - 1.5. Dimensioning: Fundamentals and techniques, size and location dimensioning, SI conversions, use of scales, measurement units, reducing and enlarging drawings, and placement of dimensions: aligned and unidirectional

2. Engineering Geometry (4 hours)
   - 2.1. Plane geometrical construction: Proportional division of lines, arc & line tangents
   - 2.2. Methods for drawing standard curves such as ellipses, parabolas, hyperbolas, involutes, spirals, cycloids and helices (cylindrical and conical)

3. Freehand Sketching and Visualization (4 hours)
   - 3.1. Sketching and design; Value of sketching as part of design
   - 3.2. Techniques of Sketching; Pencil hardness, squared paper, line densities techniques for horizontal, vertical and circular lines
   - 3.3. Multi view sketches; Choice of views, adding detail, dimensioning, title, notes proportioning and comparative sizing
   - 3.4. Sketching pictorial views; General pictorial sketching mechanical methods of sketching and proportioning isometric sketching oblique sketching perspective sketching conventional treatment of fillets, rounds and screw threads sketches of an exploded view to show assembly of components

4. Basic Descriptive Geometry(14 hours)
   - 4.1. Introduction to orthographic projection, principal planes, four quadrants or angles
   - 4.2. Projection of points on first, second, third and fourth quadrants
   - 4.3. Projection of lines: Parallel to one of the principal plane, inclined to one of the principal plane and parallel to other, inclined to both principal planes
   - 4.4. Projection planes: Perpendicular to both principal planes, parallel to one of the principal planes and inclined to one of the principal planes, perpendicular to other and inclined to both principal planes
   - 4.5. True length of lines: Horizontal, inclined and oblique lines
   - 4.6. Rules for parallel and perpendicular lines
   - 4.7. Point view or end view of a line
   - 4.8. Shortest distance from a point to a line
   - 4.9. Edge view and true shape of an oblique plane
   - 4.10. Angle between two intersecting lines
   - 4.11. Intersection of a line and a plane
   - 4.12. Angle between a line and a plane
   - 4.13. Dihedral angle between two planes
   - 4.14. Shortest distance between two skew lines
   - 4.15. Angle between two non- intersecting (skew) lines
5. Multi View (orthographic) Projections(16 hours)
   - 5.1. Orthographic projections
     - 5.1.1. First and third angle projection
     - 5.1.2. Principal views: Methods for obtaining orthographic views, projection of lines, angles and plane surfaces, analysis in three views, projection of curved lines and surfaces, object orientation and selection of views for best representation, full and hidden lines
     - 5.1.3. Orthographic drawings: Making an orthographic drawing, visualizing objects (pictorial view) from the given views
     - 5.1.4. Interpretation of adjacent areas, true-length lines , representation of holes, conventional practices
   - 5.2. Sectional views: Full, half, broken revolved, removed (detail) sections, phantom of hidden section, auxiliary sectional views, specifying cutting planes for sections, conventions for hidden lines, holes, ribs,

spokes

5.3. Auxiliary views: Basic concept and use, drawing methods and types, symmetrical and unilateral auxiliary views. projection of curved lines and boundaries, line of intersection between two planes, true size of dihedral angles, true size and shape of plane surfaces

6. Developments and Intersections(16 hours)
   6.1. Introduction and projection of solids
   6.2. Developments: General concepts and practical considerations, development of a right and oblique prism, cylinder, pyramid, and cone, development of truncated pyramid and cone, triangulation method for approximately developed surfaces, transition pieces for connecting different shapes, development of a sphere
   6.3. Intersections: Lines of intersection of geometric surfaces, piercing point of a line and a geometric solid, intersection lines of two planes, intersections of -prisms and pyramids, cylinder and an oblique plane. Constructing a development using auxiliary views, intersection of two cylinders, a cylinder & a cone

Laboratory/Practical: 3 hours/week; 15 weeks

1. Drawing sheet layout, freehand lettering, sketching of parallel lines, circles
2. Dimensioning (Unified, Aligned)
3. Applied geometry(sketch and instrumental drawing)
4. Freehand sketching and visualization
5. Descriptive geometry I: Projection of point and lines (sketch and instrumental drawing)
6. Descriptive geometry II: Projection of planes (sketch and instrumental drawing)
7. Descriptive geometry III: Applications in three dimensional space (sketch and instrumental drawing)
8. Multiview drawings (sketch and instrumental drawing)
9. Multiview, sectional drawings and dimensioning I(sketch and instrumental drawing)
10. Multiview, sectional drawings and dimensioning II (sketch and instrumental drawing)
11. Auxiliary view, sectional drawings and dimensioning (sketch and instrumental drawing)
12. Projection of regular geometrical solids (sketch and instrumental drawing)
13. Development and intersection I (sketch and instrumental drawing)
14. Development and intersection II (sketch and instrumental drawing)
15. Development and intersection III (sketch and instrumental drawing)

Reference books:

1. W. J. Luzadder, and J. M. Duff, “Fundamentals of Engineering Drawing”, Prentice Hall of India, New Delhi.
2. T. E. French, C. J. Vierck, and R. J. Foster, “Engineering Drawing and Graphic Technology”, Mc Graw Hill Publishing Co., New York.
3. N. D. Bhatt, “Elementary Engineering Drawing”, Charotar Publshing House, India.
4. P. S. Gill, “A Text Book of Engineering Drawing”, S. K. Kataria and Sons, India.
5. R. K. Dhawan, “A Text Book of Engineering Drawing”, S. Chand and Company Limited, India.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution *
1,3,5	26	20
2	4	6
4	14	12
6	16	12
Total	**60**	**50**

* There may be minor deviation in marks distribution.

WORKSHOP TECHNOLOGY

COURSE CODE: ME412

Year: I
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
1	3	-	-	-	25	25	50	

Course Objectives: The objective of the course aims at imparting knowledge and skill components in the field of basic workshop technology. It deals with different hand and machine tools required for manufacturing simple metal components.

1. Basic Workshop Materials (1 hour)
   - 1.1. Introduction to workshop technology
   - 1.2. Mechanical properties of steels and cutting materials
   - 1.3. Classification of manufacturing processes

2. General Safety Considerations (2 hours)
   - 2.1. Safety measures in construction works
   - 2.2. Safety in handling hoisting equipment and conveyors
   - 2.3. Protection in storage and manual handling of material
   - 2.4. Concept of accident and its causes
   - 2.5. Common sources of accidents
   - 2.6. Common methods of protection
   - 2.7. Electrical hazards
   - 2.8. Common precautions against electric shocks, damages and fires

3. Hand Working Operations (1 hour)
   - 3.1. Sawing
   - 3.2. Filing
   - 3.3. Threading
   - 3.4. Scribing
   - 3.5. Shearing
   - 3.6. Soldering and Riveting

4. Basic tools (1 hour)
   - 4.1. Bench tools
   - 4.2. Machinist’s hammers
   - 4.3. Screw drivers
   - 4.4. Punches
   - 4.5. Chisels
   - 4.6. Scrapers and Scribers
   - 4.7. Files
   - 4.8. Pliers and Cutters
   - 4.9. Wrenches
   - 4.10. Hacksaw
   - 4.11. Bench vise
   - 4.12. Hand drill
   - 4.13. Taps and Dies
   - 4.14. Hand shears
   - 4.15. Tapes and Squares
   - 4.16. Soldering iron
   - 4.17. Rivets

5. Measurement and Measuring Equipments (1hour)
   - 5.1. Introduction
   - 5.2. Semi – precision tools – calipers (Inside/ Outside), depth gauge, feeler gauge
   - 5.3. Precision tools – Micrometers, vernier calipers, vernier height gauge, telescopic gauge, hole gauge, bevel protractor, dial indicator, gauge blocks and surface plate

6. Drills and Drilling Processes (1 hour)
   - 6.1. Introduction
   - 6.2. Types of drill presses
   - 6.3. Work holding devices and accessories
   - 6.4. Cutting tools
   - 6.5. Geometry of drill bits
   - 6.6. Grinding of drill bits

6.7. Operations – Drilling, counter - boring, counter - sinking, reaming, honning, lapping
6.8. Cutting speeds
6.9. Drilling safety

7. Machine Tools (4 hours)
7.1. Engine lathes
7.1.1. Introduction
7.1.2. Physical construction
7.1.3. Types of lathe
7.1.4. Lathe operations (facing, turning and threading)
7.2. Shapers
7.2.1. Introduction
7.2.2. Types of shapers
7.2.3. Physical construction
7.2.4. General applications
7.3. Milling Machines
7.3.1. Introduction
7.3.2. Types of milling machines
7.3.3. Physical construction
7.3.4. Milling cutters – Plain, side, angle, end, form
7.3.5. Milling operations – Plain, side, angular, gang, end, form, keyway
7.3.6. Work holding devices
7.3.7. Cutter holding devices

7.4. Grinding Machines
7.4.1. Abrasives, bonds, grinding wheels
7.4.2. Rough grinders – Portable grinders, bench grinders, swing frame grinders, abrasive belt grinders
7.4.3. Precision grinders – Cylindrical grinders, surface grinders

8. Material Properties (1 hour)
8.1. Tool materials – Low, medium and high carbon steels; Hot and cold rolled steels; Alloy steels; Carbide and ceramic materials
8.2. Heat treating methods for steels – Annealing, tempering, normalizing, hardening, case hardening, and quenching
8.3. Non–ferrous metals

9. Sheet Metal Works (1 hour)
9.1. Introduction
9.2. Sheet metal tools
9.3. Marking and layout
9.4. Operations – Bending, cutting, rolling

10. Foundry and Forging Practice (1 hour)
10.1.Introduction
10.2.Foundry and forging tools
10.3.Foundry process: Core making, melting furnace – Cupola, sand casting
10.4.Forging operations – Upsetting, drawing, cutting, bending, punching
10.5.Forging presses and hammers
10.6.Advantages and limitations

11. Joining Processes (1 hour)
11.1.Introduction
11.2.Riveting, Soldering and Brazing
11.3.Welding – Gas welding, arc welding, resistance welding, tungsten inert gas welding (TIG), metal inert gas welding (MIG)

Laboratory/Practical: 3 hours/week; 15 weeks

Project work and Report on any four of the following:

1. Bottle opener
2. Dust bin
3. Book stand
4. Pen holder
5. Hammer
6. Gate clipper

Industrial visit (1-day):
A visit to a local industrial area and submission of field report

Reference books:

1. B.S. Raghubanshi, “A Course in Workshop Technology-Volume I”, Dhanpat Rai & Co. (P) Ltd., New Delhi.
2. B.S. Raghubanshi, “A Course in Workshop Technology-Volume II”, Dhanpat Rai & Co. (P) Ltd., New Delhi.
3. H.S. Bawa, “Workshop Technology-Volume I”, Tata McGraw- Hill Publishing Company Ltd., New Delhi.
4. H.S. Bawa, “Workshop Technology-Volume II”, Tata McGraw- Hill Publishing Company Ltd., New Delhi.
5. J. Anderson, and E. E. Tatro, “Shop Theory”, McGraw–Hill Publishing Company Ltd., India.

CONSTRUCTION MATERIALS

COURSE CODE: HE412

Year: I
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	-	50	-	50	25	125	

Course Objectives: The basic objective of the course is to introduce the students to a wide range of materials that can beused in construction and maintenance of hydropower plant project. Emphasis in the course is placed on the properties and uses of the construction material.

1. Introduction (6 hours)
   - 1.1. Scope of the subject
   - 1.2. Types of construction material
   - 1.3. Classification of construction material
   - 1.4. Properties of construction material (Physical, mechanical, thermal, chemical, and electrical)
   - 1.5. Characteristics of construction materials
     - 1.5.1. Stress/Strain diagram and their relationship
     - 1.5.2. Modulus of elasticity and Poisson's ratio

2. Basic Construction Materials (5 hours)
   - 2.1. Stones
     - 2.1.1. Types of stones
     - 2.1.2. Characteristics of good stones
     - 2.1.3. Selection and use of stone
     - 2.1.4. Deterioration and preservation of stone
     - 2.1.5. Natural bed of stone
     - 2.1.6. Dressing of stone
   - 2.2. Aggregates
     - 2.2.1. Classification of aggregates
     - 2.2.2. Characteristics of aggregates
     - 2.2.3. Deleterious materials and organic impurities
     - 2.2.4. Testing of aggregates

3. Structural Clay Products (6 hours)
   - 3.1. Introduction
   - 3.2. Clay and its classification
   - 3.3. Physical properties of clay
   - 3.4. Constituents of brick earth
   - 3.5. Ingredients of good brick earth
   - 3.6. Harmful ingredients of brick
   - 3.7. Manufacture of bricks
   - 3.8. Good qualities of bricks
   - 3.9. Classification of bricks
   - 3.10. Standard test for bricks
   - 3.11. Tiles and their type
   - 3.12. Earthen ware and glazing
   - 3.13. Application of clay product

4. Lime, Cement and Mortar (8 hours)
   - 4.1. Introduction
   - 4.2. Type, properties and uses of lime and cement
   - 4.3. Pozzolanic material
   - 4.4. Ingredients of cement
   - 4.5. Manufacture of cement (flow diagram)
   - 4.6. Composition and function of cement clinker
   - 4.7. Standard test of cement
   - 4.8. Cement water proofers
   - 4.9. Admixtures
   - 4.10. Classification of mortar
   - 4.11. Function of mortar
   - 4.12. Selection of mortar for hydropower engineering works

5. Wood and Wood Products (4 hours)
   - 5.1. Introduction
   - 5.2. Classification of tree and timber
   - 5.3. Characteristics of good timber

5.4. Growth and structure of tree
5.5. Defect of timber
5.6. Seasoning of timber
5.7. Deterioration and preservation of timber
5.8. Commercial product of timber

6. Metals and Alloys (6 hours)
6.1. Introduction
6.2. Type, properties and uses of metal
6.3. Formation of steel
6.4. Composition and properties of steel
6.5. Heat treatment process / Mechanical treatment
6.6. Steel corrosion and its treatment
6.7. Alloy of steel
6.8. Non ferrous metals
6.9. Commercial product of metals

7. Paint, Enamels, and Varnishes (4 hours)
7.1. Characteristics of an ideal paint
7.2. Function, ingredient, type and uses of paint and varnishes
7.3. Enamels
7.4. Distemper
7.5. Anti – termite treatment

8. Asphalt, Bitumen, Tar and Miscellaneous Materials (6 hours)
8.1. Type, properties and uses of asphalt, bitumen and tar
8.2. Type, properties and uses of glass
8.3. Plastic materials
8.4. Insulating materials
8.5. Gypsum products
8.6. Composite materials

Laboratory/Practical:

1. Sieve analysis of mixtures (clay, sand, gravel and crushed rock)
2. Water absorption test and bulk specific gravity test on brick sample
3. Compressive strength test of brick
4. Consistency test of cement
5. Setting time test of cement
6. Soundness test of cement
7. Compressive strength of cement
8. Toughness test (Izode/charpy) to determine the toughness of metal
9. Tensile test of ductile materials
10. Abrasion, stability and flow tests on asphalt concrete specimens

Reference books:

1. A. M. Neville, " Properties of Concrete", ELBS
2. M. S. Shetty, " Concrete Technology", S. Chand & Company Ltd., New Delhi
3. P. A. Thornton, and V. J. Colangelo, "Fundamental of Engineering Materials", Prentice Hall Publishing Company, Eaglewood Cliffs, New Jersy.
4. P. Singh, "Civil Engineering Material", Katson Books, India
5. R. K. Rajput, "Engineering Material", S. Chand & Company Ltd, New Delhi.
6. R. S. Kurmi, and R.S. Sedha, "Material Science and Processes", S. Chand & Company Ltd, New Delhi.

Evaluation Scheme:

There will be questions covering all the chapters in the syllabus. The evaluation schemes for the question will be as indicated in the table below

Chapters	Hours	Marks distribution*
1	6	4
2	5	8
3	6	6
4	8	10
5	4	6
6	6	6
7	4	4
8	6	6
Total	**45**	**50**

* There may be minor deviation in marks distribution

BASIC COMPUTER CONCEPT AND PROGRAMMING

COURSE CODE: CO411

Year: I
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	1	50	-	50	50	150	

Course Objectives: The basic objective of the course is to provide the fundamental knowledge of computer software andhigh level programming languages. Emphasis will be given on developing computer programming skills using computer programming in C languages.

1. Introduction to computer (4 hours)
   - 1.1. Introduction to computer
   - 1.2. Computer System
   - 1.3. Function of Computer
   - 1.4. Features of Computer
   - 1.5. Generation of Computer.
     - 1.5.1 First to Fifth Generation
   - 1.6. Block diagram of Computer.
     - 1.6.1. Discussion on Input Device/ Output Device
     - 1.6.2. CPU
     - 1.6.3. Memory and its types
     - 1.6.3. Uses of Computer
     - 1.6.4. Computer network
     - 1.6.5. LAN, MAN, WAN
     - 1.6.6. Managing data and Information

2. Introduction of Programming (4 hours)
   - 2.1. Introduction to Programming and Programming Languages
   - 2.2. History of C
   - 2.3. Introduction to C
   - 2.4. Importance/ Advantages of C
   - 2.5. Basic Structure of C Program
   - 2.6. Desirable program characteristic
   - 2.7. Introduction to compiler and interpreter
   - 2.8. Problem Solving using Computer
     - 2.8.1. Problem analysis
     - 2.8.2. Algorithm development
     - 2.8.3. Flowchart
     - 2.8.4. Coding
     - 2.8.5. Compilation and Execution
     - 2.8.6. Debugging and Testing
     - 2.8.7. Documentation

3. Data types, operators and some statement (5 hours)
   - 3.1. Character Sets
   - 3.2. Identifiers & Keywords
   - 3.3. Constant
     - 3.2.1. String Constant
     - 3.2.2. Numeric Constant
     - 3.2.3. Character Constant
   - 3.4. Symbolic Constant
   - 3.5. Data Types
   - 3.6. C Operators
     - 3.6.1. Arithmetic Operators (+,-,*, /, %)
     - 3.6.2. Assignment Operators
     - 3.6.3. Logical Operators
     - 3.6.4. Relational Operators
     - 3.6.5. Increment and Decrement Operators
     - 3.6.6. Bitwise Operators
     - 3.6.7. Special Operators
   - 3.7. Arithmetic Expression
   - 3.8. Operator Precedence and Associatively
   - 3.9. Type Conversions in Expressions
   - 3.10. Token in C

4. Variables, input and output (5 hours)
   - 4.1. Variable Declaration
   - 4.2. The Scope of Variable
     - 4.2.1. Register Variable
     - 4.2.2. Static Variable
     - 4.2.3. External Variable
     - 4.2.4. Automatic Variable
   - 4.3. Statements
   - 4.4. Simple C programs
   - 4.5. Input Statement
   - 4.6. Output Statement
   - 4.7. Feature of stdio.h

5. Control structure (5 hours)
   - 5.1. Conditional Statements
     - 5.2.1. if statement
     - 5.2.2. if-else statement
     - 5.2.3. switch statement
   - 5.2. Loop Statements
     - 5.2.1. for loop
     - 5.2.2. while loop
     - 5.2.3. do-while loop
   - 5.3. Breaking Control Statements
     - 5.2.1. break statement
     - 5.2.2. continue statement
     - 5.2.3. go-to statement

6. Array (4 hours)
   - 6.1. One-Dimensional Array
     - 6.2.1. One-Dimensional Array Notation
     - 6.2.2. One-Dimensional Array Declaration
     - 6.2.3. One-Dimensional Array Initialization
   - 6.2. Multidimensional Array
     - 6.2.1. Multidimensional Array Notation
     - 6.2.2. Multidimensional Array Declaration
     - 6.2.3. Multidimensional Array Initialization
   - 6.3. Processing with one dimensional Array and Multidimensional Array
   - 6.4. Array and Strings

7. Function (4 hours)
   - 7.1. Defining Function
   - 7.2. Use of Function
   - 7.3. Types of Function
   - 7.4. User-defined and Library Functions
   - 7.5. Components Associated with Function
   - 7.6. Category Of functions According to return value and Arguments
   - 7.7. Different types of Function Calls
   - 7.8. Return Statement
   - 7.9. Recursive Function
   - 7.10. Concept of Local, Global and Static Variables

8. Pointer (5 hours)
   - 8.1. Introduction to Pointer
   - 8.2. Pointer Declaration
     - 8.2.1. Indirection Or Deference Operator
     - 8.2.2. Address Operator
   - 8.3. Pointer initialization
     - 8.3.1. Bad Pointer
   - 8.4. Pointer Arithmetic
   - 8.5. Void Pointer
   - 8.6. Null Pointer
   - 8.7. Pointer Function
     - 8.7.1. Passing Pointer to a Function
   - 8.8. Pointer & Array
     - 8.8.1. Array of Pointer
     - 8.8.2. Relationship between pointer and 1-D array
   - 8.9. Pointers to pointers
   - 8.10. Dynamic Memory Allocation
   - 8.11. Application Pointer

9. Structure and Unions (5 hours)
   - 9.1. Defining a structure

9.2. Structure Initialization
9.3. Arrays of Structures, Structures with in Structures

9.3.1. Processing a Structure
9.3.2. Structures Pointers
9.3.3. Passing Structures to Functions
9.3.4. Union and its importance

10. Data Files (4 hours)
10.1. Introduction
10.2. Opening and Closing a Data File
10.3. File Opening Modes
10.4. Library Functions for Reading /Writing from / To a File
10.5. Creating a Data File
10.6. End of File (EOF)
10.7. Processing a Data File
10.7.1.Record Input / Output
10.7.2.Direct/ Random Access

Laboratory/Practical:

Several laboratory classes(minimum 6 sets of computer program from chapter 4 to 10) will be conducted as devised by concerned course instructor. Basic demonstration of computer hardware system will be also conducted.
Students maximum 4 person in a group should submit a mini project at the end of course. (20 marks out of 50 marks)

Reference Book:

1. "Let USC", Yashavant Kanetker
2. A. Kelly, and I. Pohl, "A Book on C", Benjamin/Cumming Pub. Co.
3. B.W. Keringhan, and D. M. Ritchie, "The C Programming Language", Prentice-Hall of India Pvt. Ltd., New Delhi
4. B. S. Gotterfried, "Programming with C", Tata McGrawhill, India
5. P.K.Sinha, "Computer Fundamentals", BPB Publications
6. E.Balaguruswamy, "Programming in C", Tata McGraw-Hill Publishing Company Limited
7. E.Balaguruswamy, "Graphic under C"

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	4	4
2	4	4
3	5	5
4	5	5
5	5	7
6	4	5
7	4	6
8	5	4
9	5	6
10	4	4
Total	**45**	**50**

* There may be minor deviation in marks distribution.

B.E. (HYDROPOWER) FIRST YEAR DETAIL SYLLABUS

(SECOND SEMESTER)

ENGINEERING MATHEMATICS II

COURSE CODE: SH421

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objectives: The basic objective of the course is to provide a sound knowledge of vector calculus, 3-D analytical geometry, Calculus of several variables, infinite series, and ordinary differential equations.

1. Calculus of Several Variables (5 hours)
   - 1.1. Introduction
   - 1.2. Partial derivatives, homogeneous function, Euler's theorem for the function of two and three variables, and total differential coefficients
   - 1.3. Extrema of functions of two and three variables; Lagrange's multiplier

2. Multiple Integrals (5 hours)
   - 2.1. Double integrals in cartesian and polar form; change of order of integration
   - 2.2. Triple integrals in cartesian, cylindrical and spherical coordinates;
   - 2.3. Area and volume by double and triple integrals

3. Analytical Geometry of Three Dimensional (11 hours)
   - 3.1. Plane
   - 3.2. Straight line (Co-planer lines, and the shortest distance)
   - 3.3. Sphere (Standard equation of sphere)
   - 3.4. Right circular cone and right circular cylinder

4. Vector Calculus (6 hours)
   - 4.1. Differentiation and integration of vectors
   - 4.2. Gradients , divergent, and curl

5. Infinite Series (5 hours)
   - 5.1. Introduction
   - 5.2. Convergence and divergence of a sequence
   - 5.3. Root test
   - 5.4. Absolute convergence
   - 5.5. Power series
   - 5.6. Radius and interval of convergence

6. Differential Equations (13 hours)
   - 6.1. First order and first degree differential equations
   - 6.2. Homogenous differential equations
   - 6.3. Linear differential equations
   - 6.4. Equations reducible to linear differential equations; Bernoulli's equation
   - 6.5. Second order and first degree linear differential equations with constant coefficients.
   - 6.6. Second order and first degree linear differential equations with variable coefficients; Cauchy's equations
   - 6.7. Legendre's equation
   - 6.8. Legendre polynomial function; Properties and applications.
   - 6.9. Bessel's equation and Bessel's function

Reference books:

1. E. Kreyszig, "Advance Engineering Mathematics", Wiley, New York.
2. G.B. Thomas, and R.L. Finney, "Calculus and Analytic geometry", Addison Wesley.
3. G.D. Pant, G. S. Shrestha, "Integral Calculus and Differential Equations", Sunila Prakashan,Nepal
4. M. B. Singh, B. C. Bajrachrya, "Differential calculus", Sukunda Pustak Bhandar,Nepal
5. M. B. Singh, B. C. Bajrachrya, "A text book of Vectors", Sukunda Pustak Bhandar,Nepal

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	5	4
2.	5	6
3.	11	12
4.	6	6
5.	5	6
6.	13	16
Total	**45**	**50**

APPLIED MEHANICS II (DYNAMICS)

COURSE CODE: HE421

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objectives: The objective of the course is to provide basic knowledge of engineering mechanics to the students suchthat they can understand the basics of kinematics and kinetics for both particles and rigid bodies and their motion.

1. Introduction to Dynamics (2 hours)
   - 1.1. Definition and branches of dynamics
   - 1.2. Importance of dynamics

2. Kinematics of Particles (8 hours)
   - 2.1. Rectilinear motion of particles
     - 2.1.1. Position, velocity and acceleration
     - 2.1.2. Determination of motion of a particle
     - 2.1.3. Uniform rectilinear and accelerated rectilinear motion
     - 2.1.4. Graphical solution of rectilinear- motion problem
   - 2.2. Curvilinear motion of particles
     - 2.2.1. Position vector, velocity and acceleration
     - 2.2.2. Derivatives of vector functions
     - 2.2.3. Rectangular component of velocity and acceleration
     - 2.2.4. Tangential and normal components
     - 2.2.5. Radial and transverse components

3. Kinetics of Particles (12 hours)
   - 3.1. Newton's law of motion
     - 3.1.1. Introduction
     - 3.1.2. Equation of motion
     - 3.1.3. Dynamic equilibrium
     - 3.1.4. Linear and angular momentum of a particle
     - 3.1.5. Rate of change of linear and angular momentum
     - 3.1.6. Radial and transverse component of equation of motion
     - 3.1.7. Conservation of momentum
     - 3.1.8. Newton's law of gravitation
   - 3.2. Energy and momentum methods
     - 3.2.1. Work done by a force
     - 3.2.2. Potential and kinetic energy of particles
     - 3.2.3. Principles of work and energy: applications
     - 3.2.4. Power and efficiency
     - 3.2.5. Conservation of energy
     - 3.2.6. Principle of impulse and momentum
     - 3.2.7. Impulsive motion and impact
     - 3.2.8. Direct central and oblique impact

4. System of Particles (5 hours)
   - 4.1. System of particles
   - 4.2. Linear and angular moment for a system of particles
   - 4.3. Motion of the mass centre
   - 4.4. Conservation of momentum
   - 4.5. Kinetic energy of system of particles
   - 4.6. Work energy principles; Conservation of energy for a system of particles
   - 4.7. Principles of impulse and momentum for a system of particles
   - 4.8. Steady stream of particles
   - 4.9. System with variable mass

5. Kinematics of Rigid Bodies (6 hours)
   - 5.1. Introduction
   - 5.2. Translation and rotation

5.3. General plane motion
5.4. Absolute and relative velocity in plane motion

5.5. Instantaneous centre of rotation
5.6. Absolute and relative frame; Coriolis acceleration in plane motion
5.7. Rate of change of a general vector with respect to a rotating frame; Coriolis acceleration
5.8. Motion about a fixed point
5.9. Three-dimensional motion of a particle relative to a rotating frame; Coriolis acceleration

6. Plane Motion of Rigid Bodies (6 hours)
6.1. Definitions
6.2. Equation of motion for a rigid body in plane motion
6.3. Angular momentum of a rigid body in plane motion
6.4. Plane motion of rigid body: D'Alembert's principle
6.5. Application of rigid body motion in the plane
6.6. System of rigid bodies
6.7. Constrained motion in the plane

7. Plane Motion of Rigid Bodies: Energy and Momentum Methods (6 hours)
7.1. Principle of work and energy for a rigid body
7.2. Work done by external forces
7.3. Kinetic energy for a system
7.4. Conservative and non-conservative systems
7.5. Work – energy applications
7.6. Impulse and momentum for systems for rigid bodies
7.7. Conservation of angular and linear momentum
7.8. Impulsive motion and eccentric impact

Reference books:

1. F.P. Beer, and E.R. Johnson, "Vector Mechanics for Engineers",Tata McGraw Hill Publishing Co. Ltd.
2. I. H. Shames, "Engineering Mechanics – Statics and Dynamics", New Delhi, Prentice Hall of India.
3. P. P. Egor, "Engineering Mechanics of Solids", New Delhi, Prentice Hall of India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	2	4
2	8	10
3	12	12
4	5	6
5	6	8
6	6	4
7	6	6
Total	**45**	**50**

*There may be minor deviation in marks distribution.

ENGINEERING PHYSICS

COURSE CODE: SH422

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	2	50	-	50	50	150	

Course Objectives: The basic objective of the course is to use the concept and knowledge of physics in different engineering fields.

1. Simple Harmonic Motion (5 hours)
   - 1.1. Introduction
   - 1.2. Equation of simple harmonic motion
   - 1.3. Application of simple harmonic motion (Suspended spring mass system)
   - 1.4. Free, damped, forced oscillation
   - 1.5. Angular simple harmonic motion and its application in physical pendulum, Torsion Pendulum

2. Wave motion (3 hours)
   - 2.1. Introduction to waves and particles,
   - 2.2. Types of waves
   - 2.3. Energy and power in travelling waves, intensity in wave motion
   - 2.4. Principle of superposition, reflection and interference of waves
   - 2.5. Standing waves and resonance.

3. Acoustics (3 hours)
   - 3.1. Nature and propagation of sound waves
   - 3.2. Displacement wave and pressure wave
   - 3.3. Speed of sound waves in solids, liquids and gases
   - 3.4. Beat phenomena and Doppler's effect
   - 3.5. Production and uses of ultrasound

4. Physical Optics (8 hours)
   - 4.1. Interference,
     - 4.1.1. Coherent source
     - 4.1.2. Intensity in double slit interference,
     - 4.1.3. Interference in thin films,
     - 4.1.4. Newton's rings, wedge shape
   - 4.2. Diffraction,
     - 4.2.1. Fresnel and Fraunhoffer's diffraction,
     - 4.2.2. Intensity due to a single slit
     - 4.2.3. Diffraction grating
     - 4.2.4. X-ray diffraction
   - 4.3. Polarization,
     - 4.3.1. Double refraction,
     - 4.3.2. Nichol prism, wave plates
     - 4.3.3. Plane, circular, elliptical polarization of light waves
     - 4.3.4. Optical activity, specific rotation

5. Geometrical Optics (6 hours)
   - 5.1. Lenses, combination of lenses (Contact and separation)
   - 5.2. Cardinal points,
   - 5.3. Chromatic and achromatic combination
   - 5.4. Monochromatic aberration (Spherical aberration, Coma, Curvature of field, distortion, astigmatism causes and their remedy)
   - 5.5. Fiber optics (Self focusing, Application of optical fiber)
   - 5.6. Laser: Production and uses of laser

6. Electrostatics (6 hours)
   - 6.1. Electric charge and interaction between electric changes
   - 6.2. Electric field and potential due to dipole and quardupole
   - 6.3. Gauss law: Application of Gauss law to spherical, linear and planer symmetric distribution of charges
   - 6.4. Electrostatic potential energy
   - 6.5. Capacitors, capacitor with dielectric,
   - 6.6. Charging and discharging of a capacitor

7. Electromagnetism (8 hours)
   - 7.1. Direct current: Electric current,

7.1.1. Ohm's law, resistance and resistivity, atomic view of resistivity
7.1.2. Semiconductor and superconductor (Introduction)
7.1.3. Energy loss, heat production, verification of Joules law, maximum power theorem
7.1.4 Krichhoff's law and its applications

7.2. Magnetism and Magnetic fields:
7.2.1. Source of magnetic fields
7.2.2. Magnetic force and torque, Hall effect
7.2.3. Magnetic scalar potential and potential gradient
7.2.4. Biot-savart law and its applications
7.2.5. Ampere's circuit law; magnetic fields straight conductors
7.2.6. Faraday's laws, calculation of self-inductance of solenoid.
7.2.7. LR circuit, induced magnetic field
7.2.8. Displacement current

8. Electromagnetic Waves (4 hours)
8.1. Maxwell's equations (Differential and integral form)
8.2. Application of Maxwell's equations and wave equations in free space and medium
8.3. continuity of electric current
8.4. Energy density and intensity

9. Electromagnetic Oscillation (2 hours)
9.1. LC oscillation
9.2. Damped oscillation
9.3. Forced oscillation, resonance, quality factor

Laboratory/Practical:

1. To determine the value of acceleration due to gravity (in the lab) and radius of gyration using bar pendulum.
2. To determine the value of modulus of elasticity of the given materials and moment of inertia of a circular disc using torsion pendulum.
3. To find the wave length of sodium light by measuring the diameters of Newton's rings
4. To find out the refractive index of the liquid using convex lens by parallax method.
5. To find the refractive index of the material (of given prism) using a spectrometer.
6. To determine the frequency of AC mains using sonometer.
7. To determine the wavelength of the sodium light using a plane diffraction grating
8. To determine the velocity of sound in air at room temperature with the first resonance air column and two tuning forks.
9. To find the (low) resistance using Carry Foster Bridge.
10. To determine the capacitance of a given capacitor by charging and discharging through resistor
11. To plot a graph between current and frequency in a LCR series circuit and find (i) Resonant frequenct and (ii) Quality factor.
12. To determine pole strength of a bar magnet by neutral point method.

Reference books:

1. D. Halliday, R. Resnick, and J. Walker, "Fundamentals of Physics", Wiley India Pvt. Ltd., India.
2. N. Subrahmanyam, B. Lal, and M.N. Avadhanuly, "A text book of Optics", S. Chand Limited, India.
3. A. S. Vasudeva, and K. Kishore, "Concept of Modern Engineering Physics", S. Chand & Company Ltd., New Delhi.
4. R.K Gaur, and S.L. Gupta, "Engineering Physics", Dhanpat Rai and Sons, India
5. R.N. Chaudhuri, "Waves and Oscillation", New Age International Publishers, New Delhi.
6. C.L. Arora, "Practical Physics", S. Chand & Company Ltd., India.

Evaluation Scheme:
There will be questions covering all the chapters in the syllabus. The evaluation scheme for the question will be as indicated:

Chapter	Hours	Mark distribution*
1	5	4
2	3	4
3	3	4
4	8	10
5	6	6
6	6	6
7	8	10
8	4	4
9	2	2
Total	**45**	**50**

* There may be minor deviation in mark distribution.

FUNDAMENTAL OF THERMODYNAMICS AND HEAT TRANSFER

COURSE CODE: ME421

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1.5	1	50	-	50	25	125	

Course Objectives: The objective of the course is to understand basic concepts, laws of thermodynamics and heat transfer and their applications.

1. Basic Concept of Thermodynamics (4 hours)
   - 1.1. Definition and scope of engineering thermodynamics
   - 1.2. Value of energy to society
   - 1.3. Concepts and definitions
     - 1.3.1. System; Closed systems, open systems, and isolated systems
     - 1.3.2. Properties: Intensive, extensive and specific
     - 1.3.3. Thermodynamic equilibrium
     - 1.3.4. State, process, and path (cyclic process, quasi-equilibrium process, reversible and irreversible process)
     - 1.3.5. Common properties: Pressure, specific volume, temperature
   - 1.4. Zeroth law of thermodynamics, equality of temperature

2. Energy, Work and Heat (3 hours)
   - 2.1. Energy and its type(stored energy and transient energy; total energy)
   - 2.2. Energy transfer
     - 2.2.1. Heat transfer
     - 2.2.2. Work transfer
   - 2.3. Expressions for displacement work transfer

3. Properties of Pure Substances (6 hours)
   - 3.1. Definition of pure substance
   - 3.2. Ideal gas and its relations
   - 3.3. Phase change terminology and definition(saturated liquid, triple point, critical point, moisture content, saturated vapor, superheated vapor and degree of superheat)
   - 3.4. Properties of two phase mixtures
   - 3.5. Internal energy, enthalpy, and specific heats

4. First Law of Thermodynamics (8 hours)
   - 4.1. Statements of the first law
   - 4.2. Perpetual motion machine of the first kind
   - 4.3. First law of thermodynamics for control mass undergoing cyclic process
   - 4.4. First law of thermodynamics for control volume
   - 4.5. Steady and unsteady state analysis
   - 4.6. Control volume application: Work and flow applications (steady and unsteady)

5. Second Law of Thermodynamics (8 hours)
   - 5.1. Limitations of first law of thermodynamics
   - 5.2. Statements of second law of thermodynamics
   - 5.3. Perpetual motion machine of the second kind
   - 5.4. Entropy and second law of thermodynamics for an isolated system
   - 5.5. Reversible and irreversible processes
   - 5.6. Relation for an ideal gases and incompressible substances
   - 5.7. Control mass and control volume formulation of second law
   - 5.8. Isentropic process (ideal gas and incompressible substances)
   - 5.9. Carnot cycle, carnot efficiency(heat engine, thermal efficiency, heat pump, refrigerator and coefficient of performance)

6. Thermodynamic Cycles (8 hours)
   - 6.1. Classification of cycles
   - 6.2. Otto cycle
   - 6.3. Diesel cycle
   - 6.4. Brayton cycle
   - 6.5. Rankine cycle
   - 6.6. Vapor compression refrigeration cycle

7. Heat Transfer (8 hours)
   7.1. Definition and modes of heat transfer
   7.2. Heat transfer by conduction(plane wall, hollow cylinder, composite plane wall and multilayer tube)
   7.3. Electrical analogy for thermal resistance
   7.4. Combined heat transfers and overall heat transfer coefficient for plane wall and tube
   7.5. Heat transfer by convection
   7.6. Heat transfer by radiation(Stefan's law, absorptivity, reflectivity and transmisivity (black body, white body and gray body))

Laboratory/Practical:

1. Temperature and pressure measurement
2. Compression and expansion of gases and heat equivalent of work
3. Refrigerator and/or heat pump.
4. Heat conduction and convection.
5. Heat radiation

Reference Books:

1. P.K.Nag, “Engineering Thermodynamics”, Tata Mc Graw Hill, India.
2. R.K.Rajput,“Engineering Thermodynamics”,Laxmi Publication, India.
3. E. Rathakrishnan, “Engineering Thermodynamics”, Tata Mc Graw Hill, India.
4. J. R. Howell,and R. O. Buckius, “Fundamentals of Engineering Thermodynamics", McGraw Hill Publishers, India.
5. Y. A. Cengel,and M.A. Boles,"Thermodynamics: An Engineering Approach", McGraw-Hill, India.
6. J. P. Holman, "Heat Transfer", McGraw-Hill, India.
7. Y. A. Cengel,"Heat Transfer: A Practical Approach", McGraw-Hill, India.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution *
1	4	6
2	3	4
3	6	8
4	8	8
5	8	8
6	8	8
7	8	8
Total	**45**	**50**

* There may be minor deviation in marks distribution.

ENGINEERING DRAWING II

COURSE CODE: ME422

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
1	3	-	-	50	-	50	100	

Course Objectives: The objective of the course is to make familiar with the orthographic, sectional views and pictorialdrawing. The course also emphasized with standard symbols of different engineering fields and machines.

1. Review for Orthographic and Sectional Views (6 hours)
   - 1.1. Conventional practices in orthographic views: Half views and partial views, representation of fillets and rounds
   - 1.2. Conventional practices in sectional views: Conventions for ribs, webs and spokes in sectional view, broken section, removed section, revolved section, offset section, phantom section and auxiliary sectional views

2. Pictorial Drawings (20 hours)
   - 2.1. Introduction, classifications: Advantages and disadvantages
   - 2.2. Axonometric projection
     - 2.2.1. Procedure for making an isometric drawing
     - 2.2.2. Isometric and non-isometric lines; isometric and non-isometric surfaces
     - 2.2.3. Angles in isometric drawing
     - 2.2.4. Circles and circular arcs in isometric drawing
     - 2.2.5. Irregular curves in isometric drawing
     - 2.2.6. Isometric sectional views
   - 2.3. Oblique projection and oblique drawing (rules and procedures)
   - 2.4. Perspective projection (parallel and angular)

3. Different Components and Conventions (14 hours)
   - 3.1. Limit dimensioning and machining symbols
     - 3.1.1. Limit, fit and tolerances
     - 3.1.2. Machining symbols and surface finish
   - 3.2. Threads, bolts and nuts
     - 3.2.1. Thread terms and nomenclature, forms of screw threads, symbols for bolts and nuts
     - 3.2.2. Detailed and simplified representation of internal and external threads
     - 3.2.3. Thread dimensioning
     - 3.2.4. Standard bolts and nuts: Hexagonal head square head and eye bolt
   - 3.3. Welding and riveting
     - 3.3.1. Types of welded joints and types of welds, welding symbols
     - 3.3.2. Forms and proportions for rivet heads, rivet symbols, types of riveted joints: Lap joints, butt joint
   - 3.4. Graphical symbols and conventions in different engineering fields
     - 3.4.1. Standard symbols for hydropower, civil, structural and agricultural components
     - 3.4.2. Standard symbols for electrical, mechanical and industrial components
     - 3.4.3. Standard symbols for electronics, communication and computer components
     - 3.4.4. Topographical symbols
   - 3.5. Standard piping symbols and piping drawing

4. Assembly and Detail Drawing (20 hours)
   - 4.1. Introduction to working drawing
   - 4.2. Components of working drawing: Drawing layout, drawing numbers
   - 4.3. Detail drawing
   - 4.4. Assembly and detail drawing
   - 4.5. Practices of detail and assembly drawing

Laboratory/Practical: (3 hours per week)

1. Review for orthographic and sectional views (full and half section)
2. Review for orthographic and sectional views (other type sections)
3. Isometric drawing
4. Isometric drawing (consisting of curved surfaces and sections)
5. Oblique drawing(cavalier and cabinet)
6. Perspective projection(parallel and angular)
7. Familiarization with graphical symbols (limit, fit, tolerances and surface texture symbols)

8. Familiarization with graphical symbols (symbols for different engineering fields)
9. Detail drawing
10. Assembly drawing I
11. Assembly drawing II

Reference books:

1. K. Venugopal, “Engineering Drawings and Graphics”, New Age International Publishers, New Delhi.
2. W. J. Luzadder, and J. M. Duff, “Fundamentals of Engineering Drawing”, Prentice Hall of India, New Delhi.
3. T. E. French, C. J. Vierck, and R. J. Foster, “Engineering Drawing and Graphic Technology”, Mc Graw Hill Publishing Co., New York.
4. N. D. Bhatt, “Elementary Engineering Drawing”, Charotar Publshing House, India.
5. P. S. Gill, “A Text Book of Engineering Drawing”, S. K. Kataria and Sons, India.
6. R. K. Dhawan, “A Text Book of Engineering Drawing”, S. Chand and Company Limited, India

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Mark Distribution*
1	6	6
2	20	20
3	14	8
4	20	16
Total	**60**	**50**

*There may be minor deviation in mark distribution.

BASIC ELECTRONICS ENGINEERING

COURSE CODE: EX421

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1.5	1	50	-	50	25	125	

Course Objectives: The objective of the course is to provide the knowledge of use of electronic equipments and instruments. Emphasis will be also given to the analog and digital systems and their applications in the field of engineering.

1. Introduction to Basic Circuits Concepts (6 hours)
   - 1.1 Resistor, capacitors, inductor
   - 1.2 Linear and non-linear circuits
   - 1.3 Resistive circuits: Series and parallel combinations
   - 1.4 Kirchhoff's law: Voltage, current; linearity
   - 1.5 Signal sources: Voltage and current sources; concept of gain, transconductance, transimpedance.
   - 1.6 Superposition theorem; Thevenin's theorem, norton's theorem
   - 1.7 Introduction to filter and types

2. Introduction to Diodes and its Applications (6 hours)
   - 2.1 Semiconductor devices: P type and N type
   - 2.2 Semiconductor diode characteristics
   - 2.3 Diode circuits: clipper; Clamper circuits
   - 2.4 Zener diode, LED, photodiode, varactors diode, tunnel diodes
   - 2.5 DC power supply: Rectifier-half wave, full wave (center tapped, bridge), zener regulated power Supply

3. Transistor (7 hours)
   - 3.1 BJT configuration and biasing; CE, CC, and CB amplifiers and their characteristics
   - 3.2 Concept of differential amplifier using BJT
   - 3.3 Applications of transistor: BJT as a switch and logic circuits
   - 3.4 Construction and working principle of MOSFET (N type and P type)
   - 3.5 MOSFET as logic circuits

4. Amplifiers and Oscillators (6 hours)
   - 4.1 Introduction to operational amplifiers, inverting amplifier; non-inverting amplifier
   - 4.2 Amplifier applications: Adder, substractor, integrator, differentiator, multiplier
   - 4.3 Basic feedback theory; Positive and negative feedback; concept of stability;
   - 4.4 Introduction to oscillator; generation of square wave, triangular wave using op-amps, wien bridge Oscillators

5. Basic Communication Systems (5 hours)
   - 5.1 Introduction to wired and wireless communication system
   - 5.2 Block diagram of communication systems
   - 5.3 EMW and propagation, antennas and its types
   - 5.4 Introduction to FM and AM Communications
   - 5.5 Introduction to optical fibers

6. Digital Logic (11 hours)
   - 6.1 Number systems and binary arithmetic
   - 6.2 Logic gates: OR, NOT, AND NOR, NAND, XOR, XNOR gate
   - 6.3 Multiplexers, DeMUX, encoder, decoder
   - 6.4 Logic function representation
   - 6.5 Combinational circuits: SOP, POS form; K-map
   - 6.6 Latch, flip-flop: S-R flip-flop; JK master slave flip-flop; D-flip flop

7. Types and Applications of Transducers (4 hours)
   - 7.1 Introduction to instrumentation
   - 7.2 Transducer, types and its applications
   - 7.3 Strain gauge and applications

Laboratory/Practical:

1. Familiarization with passive components, function generator and oscilloscope
2. Diode characteristics, rectifiers, zener diodes
3. Bipolar junction transistor characteristics and single stage amplifier

4. Voltage amplifiers using op-amp, comparators
5. Wave generators using op-amp (oscillators)
6. Combinational circuits

Reference books:

1. A.S. Sedra, and K.C. Smith, "Microelectronic Circuits", Oxford University Press.
2. B.L. Theraja, "Basic Electronics" S.Chand and Company Ltd., New Delhi.
3. P. B. Zbar, A. P. Malvino, and M. A. Miller, "Basic Electronics", Tata McGraw-Hill Publishing Company Ltd., New Delhi
4. R. Boylestad, and L. Nashelsky, "Electronic Devices and Circuit Theory", PHI.
5. T.L. Floyd, "Electronic Devices", Pearson Education, Inc.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	6	6
2.	6	8
3.	7	8
4.	6	8
5.	5	6
6.	11	10
7.	4	4
Total	**45**	**50**

* There may be minor deviation in marks distribution.

BASICS OF WATER RESOURCE

Course code: HE422

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50		50	25	125	

Course objective: This subject aims to provide a broad understanding of the water resources, global environment changes, and how they are related to sustainability of water resource systems.

1. Introduction 5 hrs
1.1 Background
1.2 Freshwater resources
1.3 Concept and elements of water resource systems
1.4 Systems analysis techniques
1.5 Challenges to water resources sustainability
1.6 Water budgets

2. Acquisition and processing of Water resources data 10 hrs
2.1 Types of Water resources data
2.2 Techniques for data analysis
2.4 Water resources information system
2.5 Emerging techniques for water resources data and analysis
2.6 Remote sensing and GIS applications

3. Global change and water resources 10 hrs
3.1 Changes in hydrologic cycle
3.2 Landuse land cover change
3.3 Climate change
3.4 Climate projections and uncertainty
3.5 Water pollution

4. Water withdrawals and uses 6 hrs
4.1 Categories of water utilization
4.2 In-stream and off-stream water utilization
4.3 Municipal and rural water use
4.4 Industrial water use
4.5 Water for agriculture
4.6 Water for energy production
4.7 Virtual water and water footprints

5. Water for hydropower generation 8 hrs
5.1 Principle, common terms and advantages
5.2 Components of hydropower plant
5.3 Hydropower potential
5.4 Classifications of hydropower plant
5.5 History and status of hydropower development in Nepal
5.6 Various laws, issues and constraints in hydropower development

6. Water resources planning and management 6 hrs
6.1 Integrated water resources management
6.2 Stages in water resources planning
6.3 Environmental considerations
6.4 Economic aspects
6.5 Social involvement

Tutorial/Practical:

1. Review on 'Water resources of Nepal under global change context'
2. Exercise on 'collection and analysis of water resources data'
3. Case study on 'Integrated water resources management'(1day field visit)

Reference Books:

1. Basics of Water Resources: course book, *UNESCO-IHE Delft,*2003.

2. Water Resources Engineering *by Larry W. Mays, John Wiley & Sons, 2nd Edition, 2010*.
3. Water resources systems planning and management *by S.K. Jain and V.P. Singh (Elsevier publications, 2003)*.
4. Water resources and development by Clive Agnew and Philip Woodhouse (*Routledge Taylor and Francis Group publications, 2011*).

Evaluation Scheme:

Chapters	**Hours**	**Marks distribution***
1	5	6
2	10	12
3	5	12
4	5	6
5	5	8
6	5	6
Total	45	50

* *There may be minor deviation in marks distribution.*

B.E. (HYDROPOWER) SECOND YEAR DETAIL SYLLABUS

(FIRST SEMESTER)

ENGINEERING MATHEMATICS III

COURSE CODE: SH431

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50		50		100	

Course Objectives: The basic objective of the course is to round out the students' preparation for more sophisticatedapplications with an introduction to linear algebra, Fourier series, Laplace Transforms, integral transformation theorems and linear programming.

1. Matrices and Determinants (10 hours)
   - 1.1. Algebra of matrices
   - 1.2. Determinant and its properties
   - 1.3. Properties of skew-symmetric determinant
   - 1.4. Complex matrices
   - 1.5. Rank of matrices
   - 1.6. System of linear equations
   - 1.7. Vector spaces
   - 1.8. Linear transformations
   - 1.9. Eigen value and Eigen vectors
   - 1.10. The Cayley-Hamilton theorem and its uses
2. Laplace Transform (8 hours)
   - 2.1. Definitions and properties of Laplace transform
   - 2.2. Derivations of basic formulae of Laplace transform
   - 2.3. Inverse Laplace transform: Definition and standard formulae of inverse Laplace transform
   - 2.4. Applications of Laplace transform to ordinary differential equations
3. Fourier Series (6 hours)
   - 3.1. Fourier series
   - 3.2. Periodic functions
   - 3.3. Odd and even functions
   - 3.4. Fourier series for arbitrary range
   - 3.5. Half range Fourier series
4. Integral Theorems (9 hours)
   - 4.1. Green theorems in the plane
   - 4.2. Triple integrals and divergence theorem of gauss
   - 4.3. Stroke's theorem
   - 4.4. Consequences and applications of stroke's theorem
   - 4.5. Time integrals and independence of path
5. Line, Surface and Volume Integrals (12 hours)
   - 5.1. Line integrals
   - 5.2. Evaluation of line integrals
   - 5.3. Line integrals independent of path
   - 5.4. Surfaces and surface integrals
   - 5.5. Green's theorem in the plane and its applications
   - 5.6. Stoke's theorem and its applications
   - 5.7. Volume integrals; Gauss divergence theorem and its applications

Reference books:

1. E. Kreyszig, "Advance Engineering Mathematics", Wiley, New York.
2. M.M. Gutterman and Z.N.Nitecki, "Differential Equation, a First Course", Saunders, New York.

Evaluation Scheme:
The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	**Hours**	**Marks Distribution***
1.	10	12
2	8	10
3.	6	6
4.	9	10
5.	12	12
Total	**45**	**50**

* There may be minor deviation in marks distribution.

FUNDAMENTAL OF ELECTRICAL ENGINEERING

COURSE CODE: EL431

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	1	50	-	50	25	125	

Course Objectives: The objective of the course is to provide the fundamental concept of electric circuit (AC & DC). Emphasis will be also given to operate, distinguish and use of electrical devices and machines.

1.Preliminaries and Basic Concepts (6 hours)
- 1.1. Constituent parts of an electrical system
- 1.2. Electrical units
- 1.3. Current flow in a circuit
- 1.4. Electromotive force and potential difference
- 1.5. Ohm's law, resistors and resistivity
- 1.6. General concept of capacitance and inductance
- 1.7. Temperature rise & temperature coefficient of resistance
- 1.8. Voltage & current sources

2.Basic DC Circuit Analysis and Network Theorems (12 hours)
- 2.1. Series and parallel circuits
- 2.2. Star-delta & delta-star transformation
- 2.3. Kirchoff's laws
- 2.4. Application of Kirchhoff's laws: Nodal analysis, mesh analysis
- 2.5. Power and energy
- 2.6. Superposition theorem
- 2.7. Thevenin's theorem
- 2.8. Norton's theorem
- 2.9. Maximum power transfer theorem

3. Alternating Circuits (12 hours)
- 3.1. AC systems, wave form, terms & definitions
- 3.2. Average and rms values of current & voltage
- 3.3. Phasor representation
- 3.4. AC in resistive, capacitive and inductive circuits
- 3.5. Concept of complex impedance and admittance
- 3.6. AC series and parallel circuit
- 3.7. RL, RC and RLC circuit analysis & phasor representation
- 3.8. Power in resistive, inductive and capacitive circuits
- 3.9. Power in circuit with resistance and reactance
- 3.10. Active and reactive power, power factor, its practical importance

4. Three-Phase Circuit Analysis (6 hours)
- 4.1. Basic concept & advantage of three-phase circuit
- 4.2. Phasor representation of star & delta connection
- 4.3. Voltage & current computation in 3-phase balance & unbalance circuits
- 4.4. Real and reactive power computation

5. Introduction to Transformers (4 hours)
- 5.1. Operating principle and types
- 5.2. EMF equation and phasor diagrams
- 5.3. OC and SC tests and efficiency calculation

6.D.C Machines and Motors (5 hours)
- 6.1. Introduction to DC Machines: operating principle
- 6.2 DC Motor: Operating Principle and Speed control
- 6.3 Applications of DC motors

Laboratory/Practical:

1. Measurement of voltage, current & power in DC circuit
2. Verification of Ohm's Law
3. Krichoff's voltage & current Law
4. Measurement amplitude, frequency and alternating quantities using Oscilloscope
5. Measure currents and voltages in three-phase balanced AC circuits
6. Short circuit and open circuit tests of single-phase transformer
7. Speed control of DC motors

Reference books:

1. I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. I.M. Smith," Haughes Electrical Technology", Addison-Wesley, ISR print.
3. J.R Cogdell, "Foundations of Electrical Engineering", Printice Hall, Englewood Chiffs, New Jersy.
4. S. N. Tiwari, and A. S. Bin Saroor, "A first course in Electrical Engineering", Wheeler Publishing, Allahabad.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	6	6
2.	12	12
3.	12	12
4.	6	8
5.	4	6
6.	5	6
Total	**45**	**50**

* There may be minor deviation in marks distribution.

STRENGTH OF MATERIALS

COURSE CODE: HE431

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objectives: The objective of the course is to provide basic knowledge in material behavior, stress-strain relations, types and their analysis. At the end students will have basic concept on theory of flexure and column buckling.

1. Introductions (1 hour)
   - 1.1. Types of loads and supports
   - 1.2. Statically determinate and indeterminate structures

2. Stresses and Strains (8 hours)
   - 2.1. Introductions
   - 2.2. Stress-strain diagram for steel
   - 2.3. Hook's law: axial and typical stress strain diagram for characteristics of mild steel
   - 2.4. Shear deformation and shear angle
   - 2.5. Hook's law for shearing deformations
   - 2.6. Allowable stresses and factor of safety
   - 2.7. Elongation of bars: Varying cross-sections, tapered section
   - 2.8. Compound bars subjected to axial tension and compression
   - 2.9. Relationship between modulus of elasticity, modulus of rigidity, bulk modulus and poison's ratio
   - 2.10. Temperature stresses

3. Geometrical Properties of Sections (6 hours)
   - 3.1. Axes of symmetry
   - 3.2. Centre of gravity of built-up plane figures
   - 3.3. Centre of gravity of built-up standard steel sections
   - 3.4. Moment of inertia of standard and built-up sections
   - 3.5. Polar moment of inertia
   - 3.6. Radius of gyration
   - 3.7. Product of inertia
   - 3.8. Principle moment and principle axes of inertia

4. Principal Stresses (6 hours)
   - 4.1. Introduction
   - 4.2. Principle stresses and principle planes
   - 4.3. Stresses acting on plane inclined to the direction of the applied force
   - 4.4. Stresses acting on an inclined plane subjected to two mutually perpendicular normal and shear stresses and principal strain
   - 4.5. Mohr's circle for stress and strain

5. Axial Forces, Shearing Forces and Bending Moments (8 hours)
   - 5.1. Plotting shearing force, bending moment and axial force diagrams for determinate structures (beams and frames)
   - 5.2. Concept of superposition for shear forces, bending moments and axial forces due to various combinations of loads
   - 5.3. Maximum shear force and bending moments and their positions
   - 5.4. Relationship between loads, shear forces, bending moment

6. Theory of Flexure (5 hours)
   - 6.1. Coplanar and pure bending
   - 6.2. Elastic curve
   - 6.3. Radius of curvature, flexural stiffness
   - 6.4. Analysis of beams of symmetric cross-sections and composite beams
   - 6.5. Shear stress variation in rectangular beams
   - 6.6. Bending stress
   - 6.7. Flexural formula, differential equation of deflected shape
   - 6.8. Introduction to deflection

7. Torsion (4 hours)
   - 7.1. Introduction and assumptions
   - 7.2. Derivation of torsion formulas
   - 7.3. Torsion moments in shaft
   - 7.4. Torsional stress in shaft
   - 7.5. Angle of twist

8. Introduction to Buckling (4 hours)
   8.1. Definition of buckling
   8.2. Theory of columns according to support systems
   8.3. Effective length
   8.4. Long column by Euler's formula
   8.5. Limitations of Euler's formula
   8.6. Buckling of compression member in truss

9. Thin Walled Vessels (3 hours)
   9.1. Definition and characteristics of thin walled vessels
   9.2. Types of stresses in thin walled vessels
   9.3. Calculation of stresses in thin walled vessels

Laboratory/Practical:

1. Stress-Strain curve in tension
2. Torsion test to determine modules of rigidity
3. Column behavior due to buckling
4. Deflection of simple beam
5. Impact strength of steel

Reference books:

1. R.K. Rajput, "Strength of Materials", S. Chand & Company Ltd., New Delhi.
2. F.P. Beer, and E.R. Johnson "Mechanics of Materials", Tata McGraw Hill Publishing Co. Ltd.
3. E.P. Popov,"Mechanics of Material", New Delhi, Prentice Hall of India
4. A.Pytel, and F.L. Singer, "Strength of Materials", Harper Collins, India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	1	4
2	8	8
3	6	6
4	6	6
5	8	6
6	5	6
7	4	6
8	4	4
9	3	4
Total	**45**	**50**

*There may be minor deviation in marks distribution.

FLUID MECHANICS

COURSE CODE: HE432

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	2	50	-	50	25	125	

Course Objectives: This course is aimed at teaching students the concept of water resources engineering and their application in the field of hydropower engineering. Fundamentals of fluid mechanics are taught in this semester to proceed in the application phase covered in the irrigation and hydropower engineering courses.

1. Properties of Fluids (5 hours)
   - 1.1. Definition of fluid, application in hydropower engineering
   - 1.2. Matter as solid, liquid and gas
   - 1.3. Concept of control volume and continuum in fluid mechanics
   - 1.4. Effect of shear stress on solid
   - 1.5. Classification of fluid: Ideal and real fluids, Newtonian and non-Newtonian fluids, compressible and incompressible fluids with examples
   - 1.6. Viscosity:
     - 1.6.1. Newton's law of viscosity
     - 1.6.2. Effect of temperature on viscosity
     - 1.6.3. Effect of pressure on viscosity
     - 1.6.4. Methods for finding viscosity of fluids by viscometer
   - 1.7. Definitions of common terms: Mass density, specific weight, specific gravity, specific volume, viscosity, compressibility, capillarity, surface tension, and vapor pressure

2. Fluid Statics (15 hours)
   - 2.1. Introduction, application in hydropower engineering, concept about the absolute and relative equilibrium.
   - 2.2. Atmospheric, gauge and absolute pressure.
   - 2.3. Pascal's law
   - 2.4. Hydrostatics law of pressure distribution (pressure-depth relationship)
   - 2.5. Measurement of pressure:
     - 2.5.1. Simple manometer as piezometer,
     - 2.5.2. U-tube manometer
     - 2.5.3. Differential manometer
     - 2.5.4. Bourden gauge
   - 2.6. Pressure on submerged surfaces
     - 2.6.1. Total pressure and centre of pressure
     - 2.6.2. Pressure diagram on plane surfaces
     - 2.6.3. Pressure on curved surfaces
     - 2.6.4. Computation of pressure forces on gates (plane and curve), dams, retaining structures and other hydraulic structures
   - 2.7. Equilibrium stability of floating bodies
     - 2.7.1. Buoyancy, flotation concept,
     - 2.7.2. Thrust on immersed surface and Archimedes's principle
     - 2.7.3. The stability of floating and submerged bodies.
     - 2.7.4. Metacenter, determination of metacentric height.
     - 2.7.5. Liquid in relative equilibrium (pressure variation in the case of uniform linear and radial acceleration)

3. Fluid Kinematics (5 hours)
   - 3.1. Description of fluid motion
     - 3.1.1. Langrangian method
     - 3.1.2. Eulerain method
   - 3.2. One, two- and three-dimensional flow
   - 3.3. Types of fluid flow (uniform and non-uniform, steady and unsteady, laminar and turbulent)
   - 3.4. Rotational and irrotational motion, stream function and potential function.
   - 3.5. Types of flow lines (Streamline, streak line, path line and stream tube)
   - 3.6. Principle of conservation of mass
   - 3.7. Continuity equation in cartesian and cylindrical polar coordinates (one, two and three dimensional)

4. Fluid Dynamics (12 hours)
   - 4.1. Various forces acting on fluid and introduction to navier-stroke's equation
   - 4.2. Various forms of energies in fluid flow
   - 4.3. Eulers's equation for motion and its application
   - 4.4. Bernoulli's equation and its physical meaning
   - 4.5. Practical application of Bernoulli's equation

4.5.1. Venturimeter
4.5.2. Orifice meter
4.5.4. Nozzle meter, Pitot tube

4.6. Flow through orifice (small orifice, large orifice, partially submerged orifice as well as submerged orifice)
4.7. Different hydraulic coefficients (Cv, Cc and Cd) and their determination.
4.8. Definition and classification of notches and weirs
4.9. Varying head flow such as emptying and filling of tanks
4.10. Flow past through submerged bodies
4.10.1. Drag and lift forces
4.10.2. Drag on a sphere and cylinder
4.11. Boundary layer definition, concept, thickness and theory

5. Momentum Analysis (5 hours)
5.1. Momentum principle and equations
5.2. Application of momentum equations to calculate forces on pipe bends, enlargements and reducers
5.3. Forces exerted by the jet on stationary and moving vanes of different shapes
5.4. Concept of angular momentum with examples

6. Similitude and Physical Modeling (3 hours)
6.1. Introduction to dimensional analysis (physical quantities and their dimensions)
6.2. Principal of dimensional homogeneity
6.3. Methods of dimensional analysis (Rayleigh and Buckingham π-Theorem)
6.4. Similitude, laws of similarity, distorted and undistorted model Physical model and modeling criteria (Reynolds, Froude, Euler, Weber and Mach's law with some examples)
6.5. Introduction to scale effects in model studies

Laboratory/Practical:

1. Newton's law of viscosity
2. Hydrostatic force on submerged body
3. Stability of a floating body
4. Verification of Bernoulli's equation
5. Impact of jet
6. Flow through edged orifice
7. Flow over broad-crested weir

Reference books:

1. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons.
2. D. P. Sangroula, "Fundamentals of Fluid Mechanics", Nepal Printing Support, Anamnagar, Kathmandu.
3. K. L. Kumar, "Engineering Fluid Mechanics", Eurasia Publishing house (P) Ltd. Ram Nagar New Delhi.
4. Victor and Street, "Elementary Fluid Mechanics", John Wiley and Sons Inc., Third Avenue, New York.
5. N.B. Webber,"Fluid Mechanics for Civil Engineers", Chapman and Hall.
6. P.N. Modi, and S. M. Seth, "Fluid Mechanics and Hydraulics", Standard Book House.
7. P.K. Bansal, "A text book of fluid Mechanics" Laxmi Publishers.
8. R.K. Rajput, "A text book of Fluid Mechanics", S. Chand & Company Ltd.
9. S. Ramamrutham, "Hydraulics Fluid Mechanics and Fluid Machines", Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

Evaluation Scheme:

The question will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Hours	Marks distribution*
1	5	5
2	15	15
3	5	5
4	12	15
5	5	5
6	3	5
Total	**45**	**50**

*There may be minor deviation in marks distribution.

SURVEYING I

COURSE CODE: HE433

Year: II
Semester: I

Teaching Schedule			Examination Scheme				Total Marks	Remarks
Hours/ Week			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	3	1	50	25	50	25	150	

Course Objectives: This course is to provide the basic knowledge of land measurement and surveying techniques.

Aftercompleting this course students will be able to prepare a plan and topographic maps using various instruments.

1. Introduction and Basic Concept (2 hours)
   - 1.1. Historical background , definition, objectives and classification
   - 1.2. Principle of surveying
   - 1.3. Scales, conventional symbols
   - 1.4. Precision in surveying
2. Survey Measurements and Error (2 hours)
   - 2.1. Principles of different methods of measurements
   - 2.2. Reliability of measurements
   - 2.3. Concept of error in measurements
   - 2.4. Types of errors
3. Linear Measurements (3 hours)
   - 3.1. Methods of linear measurements
   - 3.2. Instruments for linear measurements
   - 3.3. Procedure for linear measurements
   - 3.4. Accuracy, precision, errors, sources of errors and types of errors in linear measurements
   - 3.5. Correction applied in linear measurements
   - 3.6. EDM and its working principle
4. Angular Measurements (3 hours)
   - 4.1. Angles and directions
   - 4.2. Methods of determining angles and directions
   - 4.3. Angle and direction measurements with thedolite
   - 4.4. Angle measurements using a tape, plane table, and compass
5. Compass Surveying (4 hours)
   - 5.1. Meridian, bearing and azimuth
   - 5.2. System of bearing, conversion from one system to another
   - 5.3. Calculation of angles from bearings and vice versa
   - 5.4. Dip of magnetic needle
   - 5.5. Magnetic declination
   - 5.6. Errors in compass survey
6. Traverse Surveying (5 hours)
   - 6.1. Introduction
   - 6.2. Uses of traverse surveying
   - 6.3. Methods of traversing
   - 6.4. Traversing procedure
   - 6.5. Compatibility of linear and angular measurements
   - 6.6. Checks in closed and open traverse
   - 6.7. Traverse computation
   - 6.8. Plotting a traverse survey
   - 6.9. Graphical method of adjustment of error and permissible precision
   - 6.10. Omitted measurements
7. Leveling (8 hours)
   - 7.1. Definition and importance of leveling
   - 7.2. Methods of leveling
   - 7.3. Levels and level rods, foot plates, rod bubbles
   - 7.4. Temporary and permanent adjustment of level
   - 7.5. Collimation or two peg test
   - 7.6. Methods of booking and calculation of reduced level
   - 7.7. Curvature and refraction correction
   - 7.8. Classification of leveling, fly leveling, profile leveling, cross sectioning, reciprocal leveling, precise leveling
   - 7.9. Error and adjustment in leveling

8. Plane Table Survey (3 hours)
   8.1. Introduction and principles in plane table
   8.2. Methods of plane tabling
   8.3. Advantages and disadvantages of plane tabling
   8.4. Error in plane tabling

9. Theodolite (5 hours)
   9.1. Basic definition
   9.2. Construction principle and parts of theodolite
   9.3. Temporary adjustment of theodolite
   9.4. Measurement of horizontal angle, vertical angles and zenith angle
   9.5. Errors in theodolite

10. Triangulation and Trilateration (4 hours)
   10.1. Principles for triangulation and trilateration
   10.2. Introduction of EDM and total station for triangulation and trilateration
   10.3. Classification of triangulation system
   10.4. Specification of different types of triangulations

11. Area and Volume (6 hours)
   11.1. Methods of calculating the area
   11.2. Area from field measurements
   11.3. Area from plan
   11.4. Planimeter
   11.5. Area of cross-sections
   11.6. Sources of errors in computation of area
   11.7. Partition of land
   11.8. Measurement of volume from cross section, use of trapezoidal formula and prismoidal formula for computation of volume, volume by spot leveling, volume by contour plan

Field/Practical Works:

1. Linear measurement technique in plane and sloping ground with tape, ranging rod, arrow and use of abney level and clinometers
2. Traversing using chain, tape and compass
3. Two peg test and fly leveling
4. Leveling field survey to determine profile and cross section
5. Measuring two sets of horizontal angles and one set of zenithal angles
6. Traverse angle distance measurement using theodolite
7. Area measurement by using planimeter

Reference books:

1. A.M. Chandra, “Plane Surveying”, New Age International Publishers, New Delhi.
2. A.M. Chandra, “Higher Surveying”, New Age International Publishers, New Delhi.
3. B.C. Punmia, “Surveying Volume I”, Standard Book House, New Delhi.
4. B.C. Punmia, “Surveying Volume II”, Standard Book House, New Delhi.
5. N. Basnet, and M. Basnet, “Basic Surveying- II”, Benchmark Education Support Pvt. Ltd., Kathmandu.
6. N.B. Basak, “Surveying and Leveling”, Tata McGraw Hill Publishing Company Ltd., New Delhi.
7. R. Agor, “A Text Book of Surveying and Levelling”, Khanna Publishers, New Delhi.
8. S.K. Duggal, “Surveying”, Tata McGraw Hill Education Private Limited New Delhi.

Evaluation Scheme:

There will be questions covering all the chapters in the syllabus. The evaluation schemes for the question will be as indicated in the table below

Chapter	Hours	Marks Distribution*
1	2	2
2	2	3
3	3	4
4	3	4
5	4	6
6	5	6
7	8	8
8	3	2
9	5	5
10	4	5
11	6	5
Total	**45**	**50**

* There may be minor deviation in marks distribution

ENGINEERING GEOLOGY

COURSE CODE: HE434

Year/Part: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50		50		100	

Course Objective: The aim of this course is to provide knowledge of geology to the students of hydropower Engineering, to understand how rocks, minerals structures in rock, geological processes, geodynamics, geological settings of regional & local scale plays role in hydropower engineering practice.

1. Geology & Hydropower Engineering (4 hours)
   - 1.1. Definition of Geology
   - 1.2. Branches of Geology
   - 1.3. Scope, objectives & importance of Geology in Hydropower Engineering Field
   - 1.4. Rock Mechanics and Engineering Geology
   - 1.5. Geotechnical Engineering & Engineering geology
   - 1.6. Rock Engineering & Engineering geology
2. Basic Reviews of Earth (6 hours)
   - 2.1. The origin of Earth and different hypothesis
   - 2.2. Age, Component &structures (Internal & External) of the Earth
   - 2.3. History of the Earth, Geological Time Scale, origin and evolution of life
   - 2.4. Internal & External Geological Processes
   - 2.5. Plate Tectonics: Theory, Plate and Plate Boundaries
   - 2.6. Mountain and mountain Building Processes
   - 2.7. Physical features of Earth: Oceanic, continental, Plateau, Shields
3. Mineralogy& Crystallography (8 hours)
   - 3.1. Crystals & Minerals: Formation processes
   - 3.2. Elements of crystals, Symmetry elements of crystals, Crystal form, Crystal habit, Crystal System
   - 3.3. Mineral: Introduction, Physical, Chemical & Optical Properties , Classification
   - 3.4. Rock Forming Minerals
   - 3.5. Megascopic study of Quartz, Feldspars Micas, Pyroxenes, Amphiboles, Carbonates, Oxides, Halites, Carbonaceous, Evaporates, and other Minerals
   - 3.6. Hydropower Engineering significances of different minerals
4. Petrology (6 hours)
   - 4.1. Petrology, Petrography, Petrogenesis
   - 4.2. Rock & Rock Cycle
   - 4.3. Classification of Rocks and it's processes of formation (Magmatism, Sedimentation, Metamorphism)
   - 4.4. Textures, Structures and classification of different types of Rocks
   - 4.5. Physical & basic engineering properties of different rock types
   - 4.6. Macroscopic study of common rocks(Igneous, Sedimentary, Metamorphic)

5. Structural Geology (12 hours)
   - 5.1. Rock deformation: stage, Mechanism and reasons
   - 5.2. Attitudes of geological planes
   - 5.3. Measurement of orientation of geological strata in map and using geological compass in field
   - 5.4. Geological Compass and it's types
   - 5.5. Plotting of geological data on map
   - 5.6. Geological Structures: Introduction and Types(Primary and Secondary)
   - 5.7. Primary geological structures: (Beds and Bedding Planes, lamination, Cross bedding, gradded bedding, ripple marks, Mudcracks etc.
   - 5.8. Secondary Geological structures: Lineation, Foliation, Boudinage,, Cleavage, Folds, Fractures, Joints, Faults, Thrusts.
   - 5.9. Identification criteria of secondary geological structures in field
   - 5.10. Hydropower Engineering significances of geological structures

6. Physical Geology (6 hours)
   - 6.1. Introduction
   - 6.2. Geological Agents
   - 6.3. Weathering, Erosion (Types and Factors)
   - 6.4. Geological works of Geological agents (Water: Running, Underground, Lake, Sea, Wind, Glacier)
   - 6.5. Landform developed by geological works of geological agents

7. Geological and Geomorphologic division of Himalaya (3 hours)
   7.1. Geomorphological of Physiographic division
   7.2. Geological Division
   7.3. Geological Units

Practical

Following practical exercises will be performed in this course(including three days field study in real project site compulsory)

Study of Geological Time Scale
Study of Crystal system in Crystal Models
Study and Identification ofMinerals
Study and Identification of Rocks
Study and Interpretation of Geological structures in Block Diagrams

References:

A. Holmes " Principles of Physical Geology' ELBS English Language Society
M.P. Beillings: Principles of Structural Geology", Prentice Hall of India, New Delhi
P.C. Ghimire& M.S. Dhar, " Engineering Geology"
M. R. Dhital, " Geology of Himalaya, Elsevier

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	4	5
2	6	6
3	8	10
4	6	6
5	12	12
6	6	6
7	3	5
Total	**45**	**50**

*There may be minor deviation in marks distribution.

COMMUNICATION ENGLISH

COURSE CODE: SH432

Year: II
Semester: I

Teaching Schedule			Examination Scheme				Total Marks	Remarks
Hours/ Week			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	1	50	-	50	25	125	

Course Introduction:
This course is designed for the students of engineering with the objectives of developing all four skills of communication applicable in professional project.

Course Objectives: To make students able to:

1. Comprehend reading materials both technical and semi-technical in nature
2. Develop grammatical competence
3. Write notice, agenda, minutes
4. Write proposals
5. Write research articles
6. Listen and follow instruction, description and conversation in native speaker's accent.
7. Do discussion in group, deliver talk and present brief oral reports

Unit I: Oral Communication (10 hours)

1. General Rules of communication
   1.1. English sound
   1.2. Concept of affixes
2. Fundamentals of Effective Speaking: Posture, Gesture, Facial expression, Voice, Eye contact, Space distancing etc.
3. Technical Talk or Professional Talk
   3.1. Talk and speech
   3.2. Preparation and presentation of technical talk.
   3.3. Making presentation based on manuscript.
   3.4. Presenting talks based on notes.

4. Meeting
4.1. Notice preparation
4.2. Agenda preparation
4.3. Minutes preparation
4.4. Procedures of meeting conduction

Unit II: Reading (10 hours)

1. Intensive Reading

1.1. Comprehension
1.2. Note-taking and summary writing
1.3. Contextual questions based on facts and imagination
1.4. Interpreting text
2. Extensive Reading
2.1. Title/Topic speculation
2.2. Finding theme
2.3. Sketching character

Unit III: Writing (25 hours)

1. Fundamentals of Effective Writing
   1.1. Unity
   1.2. Coherence
   1.3. Conciseness
   1.4. Clarity
   1.5. Accuracy
   1.6. Composing and editing strategies

2. Writing Notices with Agenda and Minutes
2.1. Introduction
2.2. Purpose

2.3. Process

3. Proposal Writing
   3.1. Types of proposal
   3.2. Structure/ Format for technical proposals
   3.3. Writing technical proposals

4. Report Writing
4.1. Informal reports; Introduction and parts of memo report and letter report
4.2. Field/ Project report writing (Introduction and parts)
4.3. Format for formal reports
   4.3.1. Progress report
   4.3.2. Feasibility report
   4.3.3. Empirical/Research report
   4.3.4. Technical report
   4.3.5. Parts and components of formal report; Documentation

5. Letter Writing
5.1. Qualities of good letter
5.2. Structure of letter
5.3. Preparation of bio-data
5.4. Official letter format
5.5. Application letter format

6. Writing Research Articles
6.1. Introduction
6.2. Procedures

Practical:

Language Lab		30 hours
Module I: Listening Lab		12 hours
Activity I	General instruction on effective listening, factors influencing listening, note-taking to ensure attention. (Equipment required: Laptop, multimedia, laser pointer, overhead projector, power point, DVD, video set, screen)	2 hours
Activity II	Listening to recorded authentic instruction followed by exercises. (Equipment required: Cassette player or Laptop)	2 hours
Activity III	Listening to recorded authentic description followed by exercises. (Equipment required: Cassette player or Laptop)	4 hours
Activity IV	Listening to recorded authentic conversation followed by exercises. (Equipment required: Cassette player or Laptop)	4 hours
Module II: Speaking		18
Activity I	General instruction on effective speaking ensuring audience's attention, comprehension and effective use of audio-video aids. (Equipment required: Laptop, multimedia, laser pointer, overhead projector, power point, DVD, video set, screen)	2 hours
Activity II	Making students express their individual views on the assigned topics (Equipment required: Microphone, movie camera)	2 hours
Activity III	Getting students to participate in group discussion on the assigned topics	4 hours
Activity IV	Making students deliver talk either individually or in group on the assigned topics (Equipment required: Overhead projector, microphone, power point, laser pointer, multimedia, video camera, screen)	8 hours
Activity V	Getting students to present their brief oral reports individually on the topic of their choice (Equipment required: Overhead projector, microphone, power point, laser pointer, multimedia, video camera, screen)	2 hours

Reference books:

1. G. Leech, and F. Svartvik, "A Communicative Grammar of English", Pearson Education Ltd., England.
2. P. Riordan, "Technical Report Writing Today", Houghton Mifflin Company, USA.
3. N. P. Nyaupane, B. R. Pokhrel, S. Bandari, and B. P. Pokhrel, " English for Engineering", Jupiter Publishers and Distributors Ltd., Kathmandu, Nepal.
4. N. Konar, "Communication Skills for Professional", PHI LearningPrivate Ltd., New Delhi.
5. S.J. Gerson, and S. M. Gerson, "Technical Writing Process and Product", Addison Wesley Longman (Singapore) Pte. Ltd., India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Hours	Marks Distribution*
I	10	12
II	10	12
III	25	26
Total	**45**	**50**

* There may be minor deviation in marks distribution.

B.E. (HYDROPOWER) SECOND YEAR DETAIL SYLLABUS

(SECOND SEMESTER)

THEORY OF STRUCTURE I

COURSE CODE: HE441

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objectives: The basic objective of the course is to concept and knowledge of structural analysis with the emphasisof statically determinate structure. By the end of this course, it is expected that the students will be able to perform analysis of determinate structures.

1. Introduction (4 hours)
   - 1.1. Types of structures based on material used
   - 1.2. Structural mechanics
   - 1.3. Two basic approaches of structural analysis
   - 1.4. Linearly elastic structures
   - 1.5. Non-linearity in structural analysis
   - 1.6. Principle of superposition

2. Methods of Analysis (10 hours)
   - 2.1. Analysis by the strain energy method
     - 2.1.1. Strain energy and complementary strain
     - 2.1.2. Strain energy due to gradually and suddenly applied direct load: Dynamic multipliers
     - 2.1.3. Strain energy due to axial force, bending, shear and torsion
   - 2.2. Analysis by the virtual work method
     - 2.2.1. Work and complementary work
     - 2.2.2. Displacement of beams, frames and trusses by method of real work
     - 2.2.3. Calculation of real work from bending
     - 2.2.4. Limitations of the method of real work
     - 2.2.5. Displacements by the methods of virtual work in beam, frame and truss
     - 2.2.6. Direct axial and bending effects
     - 2.2.7. Effect of temperature change and misfit in fabrication of truss

3. Deformation of Beam (7 hours)
   - 3.1. Differential equation of flexure
   - 3.2. Theorems on moment area method
   - 3.3. Macaulay's method
   - 3.4. Deflection of cantilever beams
   - 3.5. Deflections in simply supported beams with and without overhangs
   - 3.6. Mid-span deflections
   - 3.7. Conjugate-beam method
   - 3.8. Deflections by the method of superposition

4. Influence Lines for Simple Structures (10 hours)
   - 4.1. Concept of influence lines
   - 4.2. Moving loads and influence lines
   - 4.3. Influence lines diagram for support reactions, support moment, shear force and bending moment for statically determinate beams
   - 4.4. Criterion of maximum reaction or shear force and bending moment in simple beam and their values
   - 4.5. Determination of reactions, bending moments and shear forces from influence line diagrams due to different loadings: Point load, distributed load, couple
   - 4.6. Loading of influence line diagrams using standard load trains
   - 4.7. Most critical position of a load on a beam span, values and location of absolute maximum bending moment and shear force
   - 4.8. Influence lines for statically determinate trusses
   - 4.9. Criterion of maximum axial force in a member of plane truss

5. Statically Determinate Arches (7 hours)
   - 5.1. Various types of arches
   - 5.2. Three-hinged circular and parabolic structures with support at same and different Level
   - 5.3. Determination of support reactions, shearing forces, normal forces and bending moments
   - 5.4. Analysis of three-hinged arches by the graphical method
   - 5.5. Influence line diagrams for reactions, bending moments, shearing forces and normal forces in three-hinged arches
6. Structures with Suspension Cable (7 hours)
   - 6.1. General equation of cable
   - 6.2. Catenary and parabolic cables
   - 6.3. Cable under uniformly distributed load
   - 6.4. Elements of a simple suspension bridges
   - 6.5. Suspension bridge with un-stiffened cable and 3-hinge stiffening girder
   - 6.6 Stress determination in three hinged stiffness girder

6.7 Influence line diagrams

Laboratory/Practical:

1. Deflection of beam
2. Experimental analysis of suspension bridges
3. Analysis of plane frames
4. Influence lines for beams and girders
5. Influence lines for frames
6. Measurement of reactions in three-hinged arches under different loading arrangements

Reference books:

1. C.H. Norris, J.B. Wilbur, and S.Utku, “Elementary structural Analysis”, New York: McGraw-Hill Book Co.
2. W. Jr.Weaver, J. M. Gere, “Matrix Analysis of Frames Structures”, CBS Publishers and Distributers, India
3. A. Darkov, and Kuznetsov, “Structural Mechanics”, Mir Publishers.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	**Hours**	**Mark distribution ***
1	4	6
2	10	12
3	7	8
4	10	10
5	7	8
6	7	6
Total	**45**	**50**

* There may be minor deviation in marks distribution.

SURVEYING II

COURSE CODE: HE442

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	3	1	50	25	50	25	150	

Course Objectives: The basic objective of the course is to introduce fundamental knowledge of land measurement andmodern survey application. After completing this course student will be able to prepare contour map by plane tabling and tachometry and also be able to survey site of hydropower plant station.

1. Tachometry (6 hours)
   - 1.1. Introduction: Definition and uses of tachometry
   - 1.2. Principle of optical distance measurements
   - 1.3. Basic systems of tachometric measurements (stadia system, non-stadia system)
   - 1.4. Booking and plotting of details
   - 1.5. Sources of errors and precision of tachometric survey

2. Trigonometric Leveling (4 hours)
   - 2.1. Problems of heights and distances
   - 2.2. Reciprocal trigonometrical leveling
   - 2.3. It's significance and error ratio
   - 2.4. Determination of heights and distances o inaccessible objects

3. Contouring (5 hours)
   - 3.1. Introduction
   - 3.2. Contours and contour lines
   - 3.3. Establishment of controls
   - 3.4. Contour interval and factors for deciding contour intervals
   - 3.5. Characteristics of contour
   - 3.6. Methods of locating contours
   - 3.7. Interpolation of contours
   - 3.8. Contour gradient
   - 3.9. Uses of contour maps

4. Intersection and Resection (4 hours)
   - 4.1. Introduction
   - 4.2. Analytical intersection and resection
   - 4.3. Two points and three point resection and their significance
   - 4.4. Instruction on field application

5. Horizontal and Vertical Curves (8 hours)
   - 5.1. Simple circular curves and their elements
   - 5.2. Calculation and setting out of simple circular curve by ordinate from long chord, offsets from tangent and deflection angle methods
   - 5.3. Geometry of transition curves and their elements
   - 5.4. Elements of composite curves and setting out techniques
   - 5.5. Equation of vertical curves and computation of reduced levels of points on curve

6. Construction Surveying (5 hours)
   - 6.1. Introduction
   - 6.2. Horizontal and vertical controls
   - 6.3. Positioning of a structure
   - 6.4. Setting out of building, culvert and bridge
   - 6.5. Setting out of penstock line and anchor blocks
   - 6.6. Surveying criteria for internal structures like tunnel linings
   - 6.7. Survey criteria for interior construction

7. Photogrammetry and Remote Sensing (5 hours)
   - 7.1. Introduction of photogrammetric as a branch of surveying and its importance
   - 7.2. Principle of photogrammetry and its limitations
   - 7.3. Scale of vertical photograph
   - 7.4. Relief displacement
   - 7.5. Necessity, importance and types of remote sensing
   - 7.6. Electromagnetic radiation (EMR)
   - 7.7. Interaction of EMR with earth surface features
8. Modern System in Surveying and Mapping (8 hours)
   - 8.1. Electronic and laser theodolite
   - 8.2. Use of astronomy in surveying and mapping

8.3. Global positioning system (introduction, components, working principles and uses of GPS)
8.4. Total station (introduction, features, characteristics, field procedures for total station in topographical surveying)
8.5. Digital terrain model (DTM)
8.6. Introduction to DGPS, Drone survey
8.7. Geographic information system (introduction, application of GIS to hydropower engineering projects)
8.8. Robots for hydropower surveying, possibility and scopes
8.9. Techniques, challenges and opportunities for the rural Nepal hydropower surveying using modern system

Practical /Field Works:

1. Traverse survey, computation and plotting using theodolite.
2. Application of tachometry to measure distance and elevation by using stadia system including detailing, computation and plotting
3. Intersection and resection using theodolite
4. Trigonometric leveling
5. Contouring – Indirect leveling
6. Setting out of simple circular curve, transition and vertical curve
7. Demonstration and application of Total Station
8. Demonstration and application of GPS, GIS, Photogrammetry lab visit

Reference books:

1. A.M. Chandra, "Plane Surveying", New Age International Publishers, New Delhi.
2. A.M. Chandra, "Higher Surveying", New Age International Publishers, New Delhi.
3. B.C. Punmia, "Surveying Volume 1", Standard Book House, New Delhi.
4. B.C. Punmia, "Surveying Volume 2", Standard Book House, New Delhi.
5. B.C. Punmia, "Surveying Volume 3", Standard Book House, New Delhi
6. N. Basnet, and M. Basnet, "Basic Surveying- II", Benchmark Education Support Pvt. Ltd., Kathmandu.
7. N.B. Basak, "Surveying and Leveling", Tata Mc Graw Hill Publishing Company Limited, New Delhi.
8. R. Agor, "A text book of surveying and Levelling", Khanna Publishers, New Delhi.
9. S.K. Duggal, "Surveying", Tata McGraw Hill Education Private Limited New Delhi.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	6	8
2	4	5
3	5	6
4	4	5
5	8	10
6	5	5
7	5	5
8	8	6
Total	**45**	**50**

*There may be minor variation in marks distribution

HYDRAULICS

COURSE CODE: HE443

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Schedule				Total Marks	Remarks
			Final		Internal Assessment			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
4	1	2	50	-	50	25	125	

Course Objectives:
The basic objective of this course is to provide the fundamental knowledge of hydraulics which aims to impart the concept of water resources engineering and their application in the field of **Hydropower Development**, water supply, irrigation, navigation engineering and some familiar applications of water resources engineering involving the utilization of water for beneficial purposes. The knowledge of hydraulics is essential to the design of various hydraulic structures.

Course Contents:

1. **Pipe Flow** (10 hours)
   - 1.1 Introduction to pipe flow and uses of continuity equation
   - 1.2 Distinguish between pipe and open channel flow
   - 1.3 Reynolds experiment and flow based on Reynolds's number.
   - 1.4 Difference between laminar flow and turbulent flow
   - 1.5 Laminar flow through pipe (Hagen Poisseuille equation).
   - 1.6 Laminar flow between parallel plates.
   - 1.7 Resistance for commercial pipes, variation of friction factor with Reynold's number, derivation of Darcy-Weisbach equation, Colebrook-White equation and its development, use of Moody's chart
   - 1.8 Shear stress and their distribution in uniform flow
   - 1.9 Minor Head losses in pipes (losses in sudden enlargement, sudden contraction, exit loss, entry loss, losses in bends and losses due to different fittings).
   - 1.10 HGL and TEL lines.
   - 1.11 Total head losses calculation in a simple pipe flow system.

2. **Pipe Flow Problems and Pipe Networks** (6 hours)
   - 2.1 Three types of pipe flow problems and their solution.
   - 2.2 Pipes in series and parallel, Dupuit's equation, Concept of equivalent pipe length and diameter.
   - 2.3 Siphons and its application, different type of problem in siphon (simple and trial & error).

3. **Unsteady Flow in Pipes** (6 hours)
   - 3.1 Basic concept for unsteady flow: celerity, derivation of Euler's equation and continuity equation.
   - 3.2 Water hammer and its causes & effects in pipes and pen-stock.
   - 3.3 Variation of pressure due to sudden closure of valve for the cases of rigid and elastic pipes (basic equation of water hammer, Rigid Water Column Theory, its limitations and Elastic Water Column Theory).
   - 3.4 Propagation of fast hydraulic transient in rigid and elastic pipe.
   - 3.5 Relieving devices against action of water hammer (major functions and different types of surge tanks).

4. **Open Channel Flow** (4 hours)
   - 4.1 Introduction to open channel flow and its practical application and its practical application.
   - 4.2 Shape of open channels.
   - 4.3 Classification of open channel flow by time, space and hydraulic regime. *(steady & unsteady, uniform & non-uniform: gradually varied, rapidly varied and spatially varied flow, and laminar, transition & turbulent; sub-super critical, critical and super critical flow).*
   - 4.3 Geometric properties of open channel flow including area of flow, wetted perimeter, and hydraulic radius.
   - 4.4 Economic channel section on plain and hilly regions.

5. **Uniform Flow** (7 hours)
   - 5.1 Conditions of uniform flow in a prismatic channel.
   - 5.2 Shear stress and velocity distribution.
   - 5.3 Flow resistance equations: Manning's equation and Chezy's equation, relationship between Chezy's coefficients (C), Manning's and Darcy's-Weisbach co-efficient.
   - 5.4 Determination and factors affecting Manning's roughness coefficient.
   - 5.5 Type of uniform flow problems and their solution.
   - 5.6 Design of hydraulically efficient channel sections (rectangular, triangular, trapezoidal and circular).

6. **Energy and Momentum Principles in Open Channel Flow** (6 hours)
   - 6.1 Energy principle, specific energy, specific energy diagram, condition for critical flow.
   - 6.2 Critical depth computations for all kind of channel sections (prismatic) and criteria for critical state of flow.
   - 6.3 Application of energy principle and critical depth concept (channel width reduction, rise in channel bed, venture flume and broad crested weir).
   - 6.4 Momentum principle, specific force, specific force curve, criteria for critical state of flow, conjugate depth.

7. Gradually Varied Flow (GVF) (8 hours)

7.1 Introduction to GVF, reasons and examples of GVF.

7.2 Basic assumptions, governing /dynamic equation and its physical meaning, differential equation of gradually varied flow.

7.3 Classification of channel bed slopes (mild, critical, steep, horizontal and adverse)

7.4 Characteristics of flow profiles in prismatic channels.

7.5 Computation of GVF in prismatic channels by graphical integration, direct step and standard step.

8. Hydraulic jump (6 hours)

8.1 The momentum equation for the jump.

8.2 Classification of the jump based on the tail water level and Froude number.

8.3 Flow condition for jump.

8.4 Hydraulic jump and its uses as an energy dissipater.

8.5 Hydraulic jumps in a horizontal rectangular channel, relation between hydraulic jump variables (conjugate depth, height of jump, length of jump) .

8.6 Energy losses in hydraulic jump and its efficiency.

8.7 Practical application of jump at spillway toe, falls etc.

9. Uniform Flow in Mobile Boundary Channel (MBC) (7 hours)

9.1 Introduction to rigid and mobile boundary channel and their differences.

9.2 Rigid boundary channel and its design principle based on minimum permissible velocity approach.

9.3 Definition of alluvial channel, shear stress distribution on the channel boundary.

9.4 Incipient motion condition.

9.5 Design of MBC by three approaches: the permissible velocity, tractive force and regime theory approaches.

9.6 Introduction to Shied diagram and its application for designing MBC.

9.7 Formation of river beds based on the shear stress.

Laboratory/ Practical:

1. Reynolds' experiment.
2. Head loss in a pipeline.
3. Flow through broad-crested weir.
4. Flow through open sluice gate.
5. Discharge measurement in open channel with channel width reduction, rise in channel bed level and venture flume.
6. Hydraulic jump analysis in open channel.
7. Computer program coding for simple problems: The algorithm and coding for Hardy-cross with one loop pipe network and problem on siphon can be included here.

Reference Books:

1. P.N. Modi and S. M. Seth, "*Fluid Mechanics and Hydraulics*".
2. K Subramanya, "*Flow in Open Channels*", Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. K.G. Ranga Raju, "*Flow through Open Channel*", Tata McGraw Hill Publishing Company Ltd.
4. J. Lal, "*Fluid Mechanics and Hydraulics*".
5. D.S. Kumar, *"Fluid Mechanics and Fluid power Engineering"*, S.K. Kataria and Sons.
6. Dr. R.K. Bansal, *"Fluid Mechanics and Hydraulic Machines"*, Laxmi Publications (P) Ltd.
7. Ven Te Chow, *"Open channel hydraulics"*, McGraw-Hill book company limited.
8. A.K. Jain, "*Fluid Mechanics and Hydraulics*".
9. R. K. Rajput : "*Fluid Mechanics and Hydraulics Machines*".
10. D.P. Sangraula and P. Bhattarai, "*A Text Book of Hydraulics*".

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below

Chapter	Hours	Marks Distribution*
1	10	8
2	6	5
3	6	5
4	4	4
5	7	6
6	6	5
7	8	6
8	6	5
9	7	6
Total	**60**	**50**

* There may be minor deviation in marks distribution.

PROBABILITY AND STATISTICS

COURSE CODE: SH441

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objectives: The basic objective of the course is to provide the students with practical knowledge of the principles and concept of probability and statistics and their application in engineering field.

1. Introduction and Descriptive Statistics (5 hours)
   - 1.1. Concept and importance of probability
   - 1.2. Addition theorem, multiplication theorem, conditional probability, and baye's theorem
   - 1.3. Introduction to statistics and its importance in engineering
   - 1.4. Describing data with graphs (bar, pie, line diagram, box plot)
   - 1.5. Describing data with numerical measure(measuring center, measuring variability)

2. Discrete Probability Distributions (5 hours)
   - 2.1. Discrete random variable
   - 2.2. Probability distribution of discrete random variables
   - 2.3. Binomial probability distribution
   - 2.4. Negative binomial distribution
   - 2.5. Poison distribution
   - 2.6. Hyper geometric distribution

3. Continuous Probability Distributions (6 hours)
   - 3.1. Continuous random variable and probability densities
   - 3.2. Probability distribution of continuous random variables
   - 3.3. Normal distribution
   - 3.4. Gama distribution
   - 3.5. Chi square distribution

2. Sampling (3 hours)
   - 4.1. Population and sample
   - 4.2. Sampling distribution and error in sampling
   - 4.3. Types of sampling

5. Estimation (5 hours)
   - 5.1. Point estimate
   - 5.2. Method of point estimation
   - 5.3. Interval estimation
   - 5.4. Confidence interval for mean
   - 5.5. Confidence interval for proportion

6. Correlation and Regression (6 hours)
   - 6.1. Simple linear regression model and principle of least square
   - 6.2. Correlation and coefficient of determination
   - 6.3. Standard errors of regression line and standard errors of parameters
   - 6.4. Multiple correlation and regression

7. Hypothesis Testing (11 hours)
   - 7.1. Errors in hypothesis testing
   - 7.2. Level of significance
   - 7.3. Hypothesis test concerning one mean
   - 7.4. Hypothesis test concerning two mean
   - 7.5. One way ANOVA
   - 7.6. Hypothesis concerning one proportion
   - 7.7. Hypothesis concerning two proportion
   - Chi square test of independence
   - 7.8.

8. Application of computer on statistical data computing (4 hours)
   - 8.1. Application of computer in computing statistical problem. eq scientific calculator, EXCEL, SPSS , Matlab, etc.

Reference books:

1. J. L. Devore, "Probability and Statistics for Engineering and the Sciences",Brooks/Cole publishing Company, Monterey, California.
2. R. A. Johnson, "Probability and Statistics for Engineers", Miller and Freund's publication.
3. S. C. Gupta,"Fundamental of Statistics", Himalaya Publishing House, India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	5	6
2	5	6
3	6	8
4	3	4
5	5	6
6	6	8
7	11	12
8	4	-
Total	**45**	**50**

* There may be minor deviation in marks distribution.

ENGINEERING HYDROLOGY

COURSE CODE: HE444

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Schedule				Total Marks	Remarks
			Final		Internal Assessment			
Lecture	Tutorial	Practical	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	1	50	-	50	25	125	

Course Objectives:
The basic objective of this course is to provide basic knowledge of surface and ground water hydrology, and hence, to demonstrate how hydrologic principles can be applied to supplement decision support systems for the hydrological analysis of water resources related projects.

Contents

1. Introduction (2 hours)
- 1.1 Definition, scope and application of Engineering hydrology
- 1.2 The hydrologic cycle and hydrological system model
- 1.3 Earth water and water budget
- 1.4 Development of hydrol-meteorogical study in Nepal

2. Hydrological Processes (9 hours)
- 2.1. Causes, forms and types of precipitation
- 2.2. Measurement of rainfall (types and adequacy of rain gauges)
- 2.3. Snow fall and its measurements
- 2.4. Estimation of missing rainfall data
- 2.5. Double mass curve method for adjustment
- 2.6. Presentation of rainfall data: mass curve, hyetograph, point rainfall
- 2.7. Estimation of mean rainfall over an area: Arithmetical mean, Thiessen-mean, Isohyetal methods
- 2.8. Development of intensity-duration-frequency (IDF) curve and equation
- 2.9. Depth-area-duration (DAD) curve

3. Abstraction or Losses from precipitation (7 hours)
- 3.1. Evaporation process
  - 3.1.1. Meteorological parameters (radiation, temperature, vapor pressure, humidity, wind)
  - 3.1.2. Energy-budget methods and mass transfer approach (Dalton's law)
  - 3.1.3. Evaporimeters
- 3.2. Evapotranspiration
  - 3.2.1. Definition
  - 3.2.2. Measurement of actual evapotranspiration: field plots and lysimeters
  - 3.2.3. Potential evapotranspiration (Penman's equation)
- 3.3. Initial Losses
  - 3.3.1. Interception
  - 3.3.2. Depression storage
- 3.4. Infiltration
  - 3.4.1. Definition and parameters
  - 3.4.2. Horton's equation
  - 3.4.3. Infiltration indices (Φ and W)
  - 3.4.4. Measurement of Infiltration: Infiltro-meter, and Rainfall simulator
  - 3.4.5. Factors affecting infiltration rates and capacity

4. Surface Water Hydrology (Runoff) (8 hours)
- 4.1. Surface runoff
  - 4.1.1 Drainage basins and its quantitative characteristics
  - 4.1.2 Runoff cycle
  - 4.1.3 Factors affecting runoff from a catchment
  - 4.1.4 Rainfall - runoff relationship
- 4.2. Stream Flow Measurement
  - 4.2.1 Stream gauging (types of gauges and measurement, selection of sites)
  - 4.2.2 Stream flow measurement by velocity area method (current meters, floats and velocity rods)
  - 4.2.3 Alternate methods of stream flow measurement (dilution technique, ultrasonic method)
  - 4.2.4 Slope area method of computing flood discharge
  - 4.2.5. Development of rating curve and its uses
  - 4.2.6. Estimation of monthly flows from rainfall
  - 4.2.7. Statistical summaries of stream flow data (daily, monthly and annual flow)

5. Hydrograph Analysis (8 hours)
- 5.1. Components of a hydrograph and its shape
- 5.2. Separation of base flow
- 5.3. Factors affecting flood hydrograph
- 5.4. Hydrograph time relationships (time of concentration, travel time and basin lag time)
- 5.5. Unit hydrographs, their uses and limitations

5.6. Derivation of unit hydrographs from isolated and complex storms

6. Hydrology of Floods (8 hours)

6.1. Definition, causes of floods and necessity of flood study
6.2. Different methods for peak flow estimation and their limitations: rational method, empirical methods, unit-hydrograph technique and flood frequency studies
6.3. Design flood and its frequency
6.4. Statistical methods of flood prediction
  6.4.1. Continuous probability distribution
  6.4.2. Return period, frequency and risk
  6.4.3. Plotting positions, frequency factors
  6.4.4. Log Pearson III method
  6.4.5. Gumbel's extreme value type I method
6.5. Empirical methods of flood estimation
6.6. Hydro-geomorphological characteristics of rivers
6.7. Methods of mitigating floods
6.8. Flow routing

7. Ground Water (3 hours)

7.1. Occurrence and distribution of ground water
7.2. Aquifers: Types, Parameters, Darcy's Law, Equations of ground water flow
7.3. Wells and their types, Yield of an open well (Steady state flow to the wells in confined and unconfined aquifers)
7.4. Recharge of ground water
7.5. Role of ground water for irrigation development in Nepal

Practical:

1. Hydrological Analysis of water resources project
2. Delineation of catchment from topo-map or google-earth image
3. Field visit 1 day and reporting of nearby Hydro-metrological Station

Reference books:

1. K. Subramanya, "Engineering Hydrology", Tata-McGraw Hill Publishing Co., New Delhi.
2. R.S. Varshney, "Engineering Hydrology", Nem Chand & Bros., Roorkee.
3. B.L. Gupta, "Engineering Hydrology", Standard Publishers and Distributors, New Delhi.
4. K.N. Dulal, and S. Baral, "Engineering Hydrology", Apex Educational Academy, Kathmandu.
5. V.T. Chow, D.R. Midment, and L.W. Mays, "Applied Hydrology", McGraw Hill International, New York.
6. Linsley, R. K., M. A. Kohler and J. L. H. Paulhus, *Hydrology for Engineers*, Tata McGrawhill Publishing Company.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below

Chapter	Hours	Marks Distribution*
1	2	2
2	9	10
3	7	8
4	8	8
5	8	9
6	8	9
7	3	4
Total	**45**	**50**

* There may be minor deviation in marks distribution.

SOIL MECHANICS

COURSE CODE: HE445

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objectives: The basic objective of the course is to provide the students the concepts of soil engineering, includingthe science and technology of soils and their application to problems in hydropower engineering. The course emphasizes the fundamentals and relevant principles of soil mechanics, gives an overall picture of the behavior of soils and describes the nature of some of the soil problems encountered in hydropower engineering.

1. Introduction (1 hour)
   - 1.1. Definition of soil engineering and geotechnical engineering
   - 1.2. Historical development of soil mechanics
   - 1.3. Soil formation and soil type.
   - 1.4. General approach of solving soil mechanics problems
2. Physical and Index Properties of Soils (4 hours)
   - 2.1. Phase diagram
   - 2.2. Simple definitions and their relationships
   - 2.3. Index properties of soils
   - 2.4. Determinations of various index properties
3. Soil Identifications and Classification (4 hours)
   - 3.1. Introduction
   - 3.2. Field Identification of soil
   - 3.3. Soil classification-Textural, ISSCS, MIT, BSCS, USCS and AASHTO soil classification system
   - 3.4. General characteristics of soils of different groups
   - 3.5. Application of soil classification system
4. Clay Mineralogy and Soil Structure (2 hours)
   - 4.1. Introduction
   - 4.2. Basic structural units of clay minerals
   - 4.3. Clay particle interaction
   - 4.4. Soil structure and fabrics
5. Compaction of Soils (3 hours)
   - 5.1. Introduction
   - 5.2. Laboratory tests (standard proctor test, modified proctor test)
   - 5.3. Factors affecting compaction
   - 5.4. Compaction specification and field control
   - 5.5. Effect of compaction on properties of soils
6. Effective Stress Principle, Capillarity and Permeability (5 hours)
   - 6.1. Introduction
   - 6.2. Principle of effective stress
   - 6.3. Physical meaning of effective stresses
   - 6.4. Capillarity in soils
   - 6.5. Permeability of soils
   - 6.6. Factors affecting permeability of soils
   - 6.7. Determinations of coefficient of permeability: Laboratory and field methods.
   - 6.8. Types of head and seepage forces
   - 6.9. Quick sand conditions and remedial measures
   - 6.10. Failures of hydraulic structures by piping and its prevention measures
7. Seepage Through Soils (4 hours)
   - 7.1. Introduction
   - 7.2. Two dimensional flow (Laplace's equation)
   - 7.3. Flow nets and its characteristics
   - 7.4. Unconfined flow
   - 7.5. Seepage in anisotropic soil condition
   - 7.6. Seepage through an earth dam on an impervious base
   - 7.7. Flow through non–homogeneous sections
   - 7.8. Prevention of erosion- protective filters
8. Stress Due to Applied Loads (5 hours)
   - 8.1. Introduction
   - 8.2. Vertical, horizontal and shear stresses due concentrated loads
   - 8.3. Boussinesq equation and Westergaard's equation
   - 8.4. Vertical stress distribution diagrams

8.5. Vertical stress beneath loaded areas
8.6. Influence diagram
8.7. New marks influence chart
8.8. Limitations of elastic theory

9. Consolidation of Soils (6 hours)
   9.1. Fundamentals of consolidation
   9.2. Contact pressure and settlement profile.
   9.3. Consolidation test
   9.4. Void ratio – pressure plots
   9.5. Normally consolidated and over consolidated clay
   9.6. Terzaghi's theory of consolidation
   9.7. Effect of disturbance on void ratio–pressure relationship
   9.8. Compression index and swell index
   9.9. Secondary consolidation settlement
   9.10. Time rate of consolidation
   9.11. Determination of coefficient of consolidation
   9.12. Calculation of consolidation settlement under a foundation
10. Shear Strength of Soil (6 hours)
   10.1. Concept of shear strength
   10.2. Principal planes and principal stresses
   10.3. Mohr-Coulomb theory
   10.4. Mohr's stress circle and failure envelop
   10.5. Inclination of the plane of failure caused by shear.
   10.6. Laboratory tests
   10.7. Direct shear test
   10.8. Triaxial shear test-general
   10.9. Consolidated drained triaxial test
   10.10. Consolidated undrained triaxial test
   10.11. Unconsolidated undrained triaxial Test
   10.12. Unconfined compression test on saturated clay.
   10.13. Stress path
   10.14. Vane shear test
   10.15. Empirical relations between undrained cohesion and effective overburden pressure.
   10.16. Shear strength of saturated and unsaturated clays
   10.17. Shear strength of sands.

11. Stability of Slopes (5 Hours)
   11.1. Introduction
   11.2. Cause of slope moment and failures
   11.3. Types of slopes and slope failures
   11.4. Definition of factor of safety and critical surfaces
   11.5. Finite slopes- forms of slip surface
   11.6. Total stress analysis
   11.7. Method of slices
   11.8. Location of the most critical circles
   11.9. Friction circle method
   11.10. Taylors stability number
   11.11. Bishops method of stability analysis
   11.12. Use of stability coefficients

Laboratory/Practical:

1. Sieve analysis of coarse and fine grained soils.
2. Determination of Atterberg limit of soils
3. Determination of In-situ density by Sand replacement method and Core Cutter Method.
4. Determination of OMC and maximum dry density
5. Unconfined compression test
6. Direct shear test
7. Constant head permeability test
8. UU Triaxial test

Reference books:

1. B. M. Das, "Principles of Geotechnical Engineering", PWS-KENT Publishing Co., Boston.
2. B. M. Das, "Introduction to Soil Mechanics", Galgotia Publication, New Delhi.
3. G. Ranjan, and A.S.R. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, New Delhi.
4. J.E. Bowles, "Physical and Geological Properties of Soils", McGraw Hill Co. Ltd., New York.
5. K. Terzagji, "Soil Mechanics in Engineering Practice", John Wiley & Sons, New York.
6. K. R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Distribution, India.

1. S.R. Kaniraj, “Design Aids in Soil Mechanics and Foundation Engineering “, Tata McGraw Hill Education Limited, New Delhi.
2. V.N.S. Murthy, “A Text Book of Soil Mechanics and Foundation Engineering in SI units“, UBS Publishers Distributors Ltd., India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	**Hours**	**Marks distribution***
1	1	2
2	4	5
3	4	5
4	2	2
5	3	4
6	5	6
7	4	5
8	5	5
9	6	6
10	6	6
11	5	4
Total	**45**	**50**

*There may be minor deviation in marks distribution.

CONCRETE TECHNOLOGY AND MASONRY STRUCTURES

COURSE CODE: HE446

Year: II
Semester: II

Teaching Schedule			Examination Scheme				Total Marks	Remarks
Hours/ Week			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objectives: The main objective of this subject is to provide students detail knowledge on concrete technology and expand it to its application in hydropower structures.

1. Introduction to Concrete and Concrete Materials (4 hours)
   - 1.1. Use of concrete in structure
   - 1.2. Detail properties of ingredients (Cement, Water, Aggregates, Mineral admixtures and Chemical Admixtures) and their influences in concrete structures.
   - 1.3. Interrelation between individual properties of ingredients to overall properties of concrete
   - 1.4. Hydration process of concrete

3. Materials Quality (2 hours)
   - 3.1. Assurance of individual ingredients quality
   - 3.2. Storage condition
   - 3.3. Quality control sequence before batching

2. Mix Design (5 hours)
   - 2.1. Defect on nominal mix design practice
   - 2.2. Probabilistic approach for mix design
   - 2.3. Importance of W/C ratio on strength and durability of concrete
   - 2.4. Importance of unit water content and types of aggregates on workability of concrete
   - 2.5. Select of appropriate code for the design of concrete mix design for different types of concrete
   - 2.6. Mix design practice for workability, strength and durability of concrete structures
   - 2.7. Mix design of Dam concrete and Roller Compacted Dam (RCD) concrete

4. Mixing Procedure (4 hours)
   - 4.1. Efficiency of different types of mixers
   - 4.2. Charging method and mixing procedures for different types of concretes
   - 4.3. Mixing of Dam and RCD concrete in batching plant

5. Quality Control of Fresh Concrete (5 hours)
   - 5.1. General workability test methods
   - 5.2. Workability test methods for mass (Dam and RCD) concrete
   - 5.3. Quality control of fresh concrete in extreme weather
   - 5.4. Transportation of concrete from batching plant to construction site
   - 5.5. Precautions on placing and compaction of concrete
   - 5.6. Method for placing and compaction of mass (Dam and RCD) concrete
   - 5.7. Curing method of concrete in different environmental conditions
   - 5.8. Grouting work in Dam construction

6. Properties of Hardened Concrete (5 hours)
   - 6.1. Three phases of hardened concrete
   - 6.2. Modulus of Elasticity
   - 6.3. Effect of different parameters on strength of concrete
   - 6.4. Different strength testing method of hardened concrete
   - 6.5. Relation of different strengths with compressive strength of concrete
   - 6.6. Non-destructive tests of hardened concrete
   - 6.7. Strength tests for Dam and RCD concrete

7. Durability of Concrete (4 hours)
   - 7.1 Effect of water and permeability on concrete durability
   - 7.2 Physical and chemical causes of concrete deterioration
   - 7.3 Alkali-Aggregate Reaction
   - 7.4 Corrosion of steel in concrete: Reasons and preventive measures
   - 7.5 Maintenance provisions of hydraulic structures

8. Introduction to Masonry Structures (4 hours)
   - 8.1. Brick and Stone Masonry
   - 8.2. Properties of joint mortar
   - 8.3. Types of Bond
   - 8.4. NBC codal provisions for masonry structure design
   - 8.5. Unreinforced and reinforced masonry structures
   - 8.6. Design criteria for masonry walls (determination criteria of permissible stress)
   - 8.7. Different bands in masonry structures

9. Design of Masonry Walls (8 hours)
   - 9.1. Design of solid walls, walls with openings, stiffened walls and column under vertical loads
   - 9.2. Performance of masonry structures in lateral loads
   - 9.3. Failure behavior of masonry structures in lateral loads
   - 9.4. In-plane and out-of-plane behavior of masonry structures
   - 9.5. Ductile behavior of reinforced and unreinforced masonry structures
   - 9.6. Design of compound walls and retaining walls under lateral loads
   - 9.7. Elements of lateral load resisting masonry system

10. Testing of Masonry Structures (4 hours)
   - 10.1. Determination of mortar strengths
   - 10.2. Determination of brick strengths
   - 10.3. Determination of stone strengths
   - 10.4. Determination of masonry wall
   - 10.5. Non-destructive test methods

Laboratory/Practical:

Concrete Technology

1. Gradation/Properties of aggregates
2. Concrete Mix design: Nominal mix, DoE, ACI and IS Method
3. Workability and strength test of concrete cubes, cylinders, prisms

Masonry Structures

1. Test of bricks on compression
2. Test of wall on compression

Reference books:

1. A.M. Neville, and J.J. Brook, "Concrete Technology", International Students Edition.
2. B.L. Gupta, and A. Gupta, "Concrete Technology", Standard Publishers Distributors, New Delhi.
3. M. S. Shetty, "Concrete Technology: Theory and Practice", S. Chand, New Delhi.
4. P.K. Mehta, and P. J.M. Monteiro, "Concrete, Microstructure, Properties and Materials", University of California, Berkley (Indian Edition)
5. A.S. Arya, "Masonry and Timber Structures including earthquake resistant Design", Nem Chandra and Bros, Roorkee.
6. A.W. handry, B.P. Sinha, and S.R. Davies, "An Introduction to Load Bearing Brick Design", University of Edinburgh.
7. P. Dayaratnam, "Brick and Reifnorced Brick Structures", Oxford and IBH Publishing Co. Pvt. Ltd., USA.
8. Nepal National Building Code (NBC) 109.

Evaluation scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	4	4
2	2	3
3	5	6
4	4	4
5	5	8
6	5	4
7	4	4
8	4	8
9	8	5
10	4	4
Total	**45**	**50**

* There may be minor variation in marks distribution

B.E. (HYDROPOWER) THIRD YEAR DETAIL SYLLABUS

(FIRST SEMESTER)

THEORY OF STRUCTURES II

COURSE CODE: HE451

Year: III
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	2	50	-	50	25	125	

Course Objectives: The objective of the course emphasizes the basic concepts and theorems on static (equilibrium),geometrical (compatibility) and physical (force, stiffness and displacements) conditions in the context of indeterminate systems.

1. Introduction (1 hours)
   - 1.1. Definition and types of indeterminate structures
   - 1.2. Indeterminacy of structural systems its physical meanings and its types
   - 1.3. Degree of static indeterminacy and kinematic indeterminacy of a system, and its determination

2. Theorem on Displacements (3 hours)
   - 2.1. Maxwell's theorem
   - 2.2. Castigliano's theorem
   - 2.3. Betti's law

3. Force Method (10 hours)
   - 3.1. Definitions and explanations
   - 3.2. Equilibrium conditions and compatibility equations
   - 3.3. Flexibility matrix: generations and calculations
   - 3.4. Analysis of statically indeterminate beams and frames by force method
   - 3.5. Analysis of statically indeterminate beams and frames including yielding of support
   - 3.6. Analysis of statically Indeterminate trusses including temperature effects
   - 3.7. Analysis of two-hinged Parabolic arches including yield of support and temperature effect

4. Slope-Deflection Method (6 hours)
   - 4.1. Introduction
   - 4.2. Derivation of the slope-deflection equations
   - 4.3. Analysis of statically indeterminate beams including support settlement and rotation of joints
   - 4.4. Analysis of statically indeterminate rigid frames without and with unknown joint translation
   - 4.5. Analysis of statically indeterminate rigid frames due to yielding of support

5. Moment Distribution Method (6 hours)
   - 5.1. Introduction
   - 5.2. Stiffness
   - 5.3. Carry-over factors and distribution factors
   - 5.4. Cases of symmetry and anti-symmetry
   - 5.5. Analysis of statically indeterminate beams and frames

6. Influence Line (IL) for Indeterminate Structures (6 hours)
   - 6.1. Introduction
   - 6.2. Influence lines for statically indeterminate beams
   - 6.3. Mueller Breslau principle its physical meaning and its use
   - 6.4. Drawing of ILD by Mueller Breslau principle
   - 6.5. IL diagrams for reaction, bending moment and shear force in various sections of continuous beams (two to three spans only)
   - 6.6. Influence lines for statically indeterminate trusses

7. Matrix Method (8 hours)
   - 7.1. Introduction (Flexibility and stiffness)
   - 7.2. Flexibility and stiffness matrix
   - 7.3. Relationship between flexibility and stiffness matrix
   - 7.4. Analysis of statically indeterminate beams, frames and trusses by matrix method

8. Introduction to Plastic Analysis (5 hours)
   - 8.1. Definitions and explanations
   - 8.2. Plastic analysis of bending members
   - 8.3. Plastic bending
   - 8.4. Plastic hinge and its length
   - 8.5. Load factor and shape factor
   - 8.6. Collapse loads
   - 8.7. Collapse with tied loads for simple cases of statically indeterminate beams and frames

Laboratories/Practical:

1. Continuous beams (propped cantilever, two spanned beams with various end conditions)
2. Two hinged arch
3. Symmetrical portal frame
4. Unsymmetrical portal frame

Reference books:

1. A. Ghali, and A.M. Neville, “Structural Analysis, A Unified Classical and Matrix Approach”, Chapman and Hall, New York.
2. C.H. Norris, J.B. Wilbur, and S. Utku, “Elementary Structural Analysis”, McGraw-Hill International Editions, Civil Engineering Series, India
3. G.S. Pandit, and S.P. Gupta,“Structural Analysis, A Matrix Approach”, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. C.S. Reddy, “Basic Structural Analysis”, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. C.K. Wang, “Intermediate Structural Analysis”, McGraw-Hill International Editions, Civil Engineering Series, India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus as far as practicable. The approximate mark allocation to the questions is proposed to be as indicated in the table below:

Chapters	Hours	Mark distribution*
1	1	2
2	3	5
3	10	10
4	6	5
5	6	6
6	6	6
7	8	10
8	5	6
Total	**45**	**50**

* There may be minor variation in marks distribution

FUNDAMENTALS OF HYDROPOWER

Course code:HE452

Year/Part: III/I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50		50		100	

Course Objectives: The main objective of the course is to provide the student the fundamental knowledge of hydropower engineering in planning phase. Student will be able to choose the hydropower project.

1. Introduction (5 Hours)
   - 1.1. Definition of Hydropower and Basic Concept
   - 1.2. History of Hydropower Development in world and in Nepal
   - 1.3. Status of Hydropower Projects in Nepal
   - 1.4. Current and Future Hydropower Development Trend
   - 1.5. Opportunities and Challenges of Hydropower Development in Nepal
   - 1.6. Role of government institution involved in power sector development

2. Investigation of Hydropower Projects (6 Hours)
   - 2.1. Basic Investigation
   - 2.2. Purpose Oriented Investigations
   - 2.3. Planning Parameters and Data
   - 2.4. Power Market of Nepal
   - 2.5. Hydrology
   - 2.6. Topography
   - 2.7. Geology
   - 2.8. Environments Study
   - 2.9. Project Appraisal

3. Planning of Hydropower Projects (7 Hours)
   - 3.1. Hydropower Development Cycle
   - 3.2. Licensing provision of hydropower at different stages
   - 3.3. Reconnaissance Study
   - 3.4. Pre-feasibility Study
   - 3.5. Feasibility Study
   - 3.6. Detail Study

4. Power regulation (5 hours)
   - 4.1. Primary and secondary power
   - 4.2. Plant & installed capacity
   - 4.3. Mean & peak load
   - 4.4. Load curve, load capacity, utilization and diversity factor
   - 4.5. Power variation (daily, weekly, monthly and annual variation of power)
   - 4.6. Power grid & its component

5. Optimization (6 hours)
   - 5.1. Optimization of dam height, reservoir
   - 5.2. Optimization of installed capacity
   - 5.3. Optimization of water resources in multipurpose projects.

6. Structural planning of hydropower (5 hours)
   - 6.1. Structural components of hydropower
   - 6.2. General layout of hydropower projects (R-O-R, Reservoir, Inter-basin transfer mode)
   - 6.3. Selection of position of intake and power house
   - 6.4. Planning of water ways and penstocks

7. Operation of Hydropower Projects (6 Hours)
   - 7.1. Concept of Hydropower Operation
   - 7.2. Initial Test of Hydropower Production and its importance
   - 7.3. Management of Hydropower Installation
   - 7.4. Electro Mechanical Equipment
   - 7.5. Erection, Acceptance and Commissioning of Works
   - 7.6. Hydropower Production Regulations
   - 7.7. Transmission Works

8. Environmental aspects of Hydropower (5 hours)
   - 8.1. Concept of Environmental assessment
   - 8.2. Legal Provision of environmental assessment
   - 8.3. Concept of EIA and IEE
   - 8.4. Environmental, Social and Cultural consideration
   - 8.5. Effect of high dam on environment.
   - 8.6. Hydropower and tourism .

   Tutorial:
   1. A general layout of hydropower should be drawn on topo-map with appropriate location of each component.
   2. Study of treaty between the government of Nepal and government of India to hydropower development.

   Field Visit:
   Field visit of 3 days hydropower plant including reservoir project, peaking run-off project and run-off-river project.

References:

1. Ravn, J., " Planning and Implementation of Hydropower Projects", NTNU, Norway, 1992
2. Bhave, P., "Water Resources Systems", Narosa Publishing House, New Delhi, 2011
3. Loucks, D. P., Stedinger, J. R., and Haith, D. A., "Water Resource Systems Planning and Analysis", Prentice-Hall, Inc. New Jersey, 1981.
4. S. Baral, "Fundamental of Hydropower Engineering", Engineering and Education Service Pvt. Ltd. Kathmandu.
5. M.M. Dandekar and K.N. Sharma, "Water Power Engineering",Vikash Pubkication House Pvt.Ltd, India
6. Recent Journal Articles published in International Journals
7. Manuals and leaf-let provided from Hydropower Projects

Evaluation Scheme:

The questions will cover all the chapters of the syllabus as far as practicable. The approximate mark allocation to the questions is proposed to be as indicated in the table below:

Chapters	Hours	Mark distribution*
1	5	5
2	6	8
3	7	8
4	5	5
5	6	6
6	5	5
7	6	8
8	5	5
Total	**45**	**50**

* There may be minor variation in marks distribution

COMPUTATIONAL TECHNIQUES

COURSE CODE: HE453

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	0	50	25	125	

Course Objectives: To provide knowledge of numerical solutions and computational techniques of various hydropower engineering problems related to water resources engineering and their computer implementation using algorithms and programs. This would be the prerequisite course of Modeling in Water Resources.

1. Introduction (7 hours)
   - 1.1 Computational Techniques
   - 1.2 Domain
   - 1.3 Discretization of domain
   - 1.4 Boundary and Initial Conditions
   - 1.5 Model and classification of modeling in water resources field
   - 1.6 Steps for numerical simulation
   - 1.7 Types of computational techniques (brief description, available software, application fields, advantages and disadvantages, comparison)
     - 1.7.1 Finite element method
     - 1.7.2 Finite difference method
     - 1.7.3 Boundary element method
     - 1.7.4 Discrete element method
     - 1.7.5 Smoothed particle hydrodynamics
   - 1.8 Tasks in numerical simulation
     - 1.8.1 Pre processing
     - 1.8.2 Processing
     - 1.8.3 Post processing
   - 1.9 Review of programming methods: (Matlab or Fortran or C)

2. Solutions of linear equations (8 hours)
   - 2.1 Linear equations
   - 2.2 Sparse matrix and dense matrix
   - 2.3 Band matrix
   - 2.4 Data storage and memory optimization
   - 2.5 Techniques of memory optimization
   - 2.6 Solution techniques of linear equations
     - 2.6.1 Cramer's rule
     - 2.6.2 Gaussian elimination technique
     - 2.6.3 Gaussian-Jordan elimination technique
     - 2.6.4 Gauss Seidel iteration
     - 2.6.5 Conjugate gradient method
3. Elasticity in solids (7 hours)
   - 3.1 Equilibrium equations for 3D element
   - 3.2 Stress displacement relationship
   - 3.3 Constitutive relation
     - 3.3.1 3D state of solid
     - 3.3.2 Lames constants
   - 3.4 Application of constitutive relation for different types of problem (definition, examples, constitutive relation for each type of problem)
     - 3.4.1 Plane stress problems
     - 3.4.2 Plane strain problems
     - 3.4.3 Axi-symmetric problems

4. Finite difference method (14 hours)
   - 4.1 Taylor's series expansion
   - 4.2 Finite difference equations
   - 4.3 Approximating techniques of solution
     - 4.3.1 Forward difference approximation
     - 4.3.2 Backward difference approximation
     - 4.3.3 Central difference approximation
   - 4.4 Finite difference equation to approximate second order derivative
   - 4.5 Order of accuracy

4.6 Consistency, convergence and stability
4.7 Explicit scheme with its advantages and disadvantages
4.8 Implicit scheme with its advantages and disadvantages
4.9 1D Saint Venant equation for unsteady non-uniform open channel flow (Continuity and momentum equation)
4.10 Common simplifications of 1D Saint Venant equation (different models)
4.10.1 Dynamic wave model
4.10.2 Diffusive wave model
4.10.3 Kinematic wave model
4.11 Stability of numerical scheme
4.11.1 Stability of explicit dynamic wave model
4.11.2 Stability of explicit kinematic wave model
4.12 Steps in Finite difference method
4.13 Numerical schemes for Saint Venant equations
4.13.1 Leap-frog scheme
4.13.2 Four point implicit scheme
4.14 Linear schemes for kinematic wave model
4.14.1 First order accurate implicit scheme
5.14.1.1 Derivation of finite difference equations
5.14.1.2 Algorithm for flow routing
4.14.2 First order accurate explicit scheme
4.14.3 Second order accurate explicit scheme
4.15 Non linear scheme for kinematic wave model
4.15.1 First order accurate implicit scheme
4.15.2 Second order accurate explicit scheme
4.16 Numerical scheme for dynamic wave model
4.16.1 First order accurate explicit scheme
4.16.2 Second order accurate explicit scheme
4.16.3 Implicit scheme for dynamic wave model
4.17 Numerical diffusion and damping

5. Method of characteristics (7 hours)
5.1 Introduction
5.2 Characteristics
5.3 Initial and boundary conditions
5.4 Governing equations for unsteady pipe flow
5.5 Application of method of characteristics in unsteady pipe flow problems
5.5.1 Numerical solution of unsteady pipe flow problems using fixed grids
5.5.2 Numerical solution of unsteady pipe flow problems in terms of hydraulic gradient line and discharge
5.5.3 Algorithm to solve water hammer effect
5.5.4 Method of characteristics when characteristics do no meet grid points
5.6 Application of method of characteristics in gradually varied unsteady open channel flow

6. Simulation of ground water flow (6 hours)
6.1 Governing equations for ground water flow
6.2 Numerical scheme for ground water flow
6.3 Simulation of seepage under dam
6.4 River stage - water table interaction

7. Finite element method (11 hours)
7.1 Coordinate systems – global, local and natural
7.2 Direct stiffness method
7.2.1 Stiffness matrices for bar, truss and beam elements
7.2.1.1 Examples on bar, truss and beam elements
7.2.1.2 Hermite interpolation for beam element
7.2.2 Constant strain triangle element
7.2.2.1 Forces in CST element – body force and traction force
7.2.2.2 Examples on CST elements

Laboratory/Practical:
1. Use of Matlab to solve open channel flow problems
2. Use of Fortan to solve water resources problems
3. Domain creation and mesh generation using finite difference method
4. Mesh generation using finite element method

Reference Books:

1. L. W. Mays, “Water Resources Engineering”, John Wiley & Sons, Inc.
2. J. H. Ferziger, M. Peric, “Computational Methods for Fluid Dynamics”, Springer.
3. M. S. Bhatti, “Fundamental Finite Element Analysis and Applications”, John Wiley & Sons, Inc.
4. S. C. Jain, “Open – Channel Flow”, John Wiley & Sons, Inc.

5. K. B. Thapa, “Application of Computational Techniques in Civil Engineering”,
6. W. H. Press, S. A. Teukolsky, W. T. Vetterling, B. P. Flannery, “Numerical Recipes in C, The Art of Scientific Computing”, Cambridge University Press.
7. P. Karasudhi, “Foundation of Solid Mechanics”, Kluwer Academic Publishers.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	7	6
2	8	8
3	7	6
4	14	12
5	7	6
6	6	4
7	11	8
Total	60	50

* There may be minor deviation in marks distribution.

FOUNDATION ENGINEERING

COURSE CODE: HE454

Year: III
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	25	125	

Course Objectives:

The objective of the course is to provide the student with the basic concepts and tools that can be used to determine the structure/ foundation/ soil interactions.

1. Introductions (1 hour)
   - 1.1. Foundation engineering, importance and classification
   - 1.2. General requirement
   - 1.3. Factors influencing the choice of a foundation
   - 1.4. Selection of the type

2. Sub surface Explorations (10 hour)

2.1 Purpose of Sub surface Explorations
- 2.2 Stages of Sub surface Explorations
- 2.3 Components of Sub surface Investigations
- 2.4 Test Pits and Trenches, Drilling (focus on core drilling), Drifts, Shafts
- 2.5 Soil Sampling, Coring
- 2.6 Geophysical Investigations
- 2.7 In-Situ Testing
- 2.8 Number/Spacing and Depth of Boreholes
- 2.9 Measurement of Ground Water Table
- 2.10 Bore Hole Logs and Preparation of Site Investigation Report

3. Lateral Earth Pressure and Retaining Structure Design (9 hour)
   - 3.1 Different Earth Pressure Theories (Analytical and Graphical)
   - 3.2 Seismic Earth Pressure Theory
   - 3.3 Conventional Retaining Walls, Proportioning of Retaining walls
   - 3.4 Earth Pressure on Retaining Wall, Stability of Retaining Walls
   - 3.5 Retaining wall Drainage, Joints and Wall Settlements

4. Flexible Retaining Structures and Coffer Dams (3 hour)
   - 4.1 Introduction
   - 4.2 Cantilever Sheet pile Walls
   - 4.3 Anchored Sheet Pile Walls
   - 4.4 Cofferdams
   - 4.5 Braced cuts and drainage

5. Bearing Capacity and Settlement of Foundations (10 hour)
   - 5.1 Classical Bearing Capacity Theories in Cohesive and Cohesion less Soils
   - 5.2 Bearing Capacity Correlations from Field Tests
   - 5.3 Bearing Capacity of Foundations on Slopes
   - 5.4 Requirements of Foundations, Loads on Foundations
   - 5.5 Bearing Capacity of Foundations on rocky bed
   - 5.6 Settlement of Foundations (Elastic, primary and secondary settlement)
   - 5.7 Foundation for transmission line tower and poles
   - 5.8 Pile Load Capacity (Based on field and lab test data)
   - 5.9 Elastic Settlement of Piles
   - 5.10 Anchor piles, Batter piles
   - 5.11 Uplift capacity of pile
   - 5.12 Wells, Piers and Caissons

6. Machine Foundations (6 hour)

6.1 Types of machines and foundations
- 6.2 General requirement of machine foundation
- 6.3 Permissible amplitude

6.4 Allowable soil pressure
- 6.5 Permissible stresses of concrete, steel and timber
- 6.6 Machine foundation subjected to steady state vibrations and impact loads

7. Design of Under Seepage Control Measures for Earth and Rockfill Dams (3 hour)
   7.1General principles
   7.2 Measure of under seepage control
   7.3 Selection of seepage control measures
   7.4 Grouting
   7.5 Drainage

8. Foundation Soil Improvements (3 hour)
   8.1. Introduction
   8.2. Mechanical compaction.
   8.3. Dynamic compaction.
   8.4. Preloading
   8.5. Sand compaction piles and stone columns
   8.6. Soil stabilization by use of admixtures
   8.7. Soil stabilization by injection of suitable grouts

Laboratory/Practical

One day observation tour of a site investigation projects and each student should prepare a brief report.

References:

1. Joseph E Bowels, "Foundation Analysis and Design" McGraw-Hill International Editions
2. Braja M.Das "Principles of Foundation Engineering" Thompson/Brookscole
3. V.N.S.Murthy," Advanced Foundation Engineering", CBS Publishers Distributors Ltd.
4. H.G.Paulos and E.H.Davis "Pile Foundation Analysis and Design" John Wiley and Sons
5. Gopal Ranjan and ASR Rao,"Basic and Applied Soil Mechanics", New Age International Publishers
6. Saran, S "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt. Ltd.
7. ASTM and IS Codes for Foundations and Substructures

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Mark Distribution*
1	1	2
2	10	10
3	9	8
4	3	4
5	10	10
6	6	6
7	3	5
8	3	5
Total	**45**	**50**

* There may be minor deviation in marks distribution.

GEOGRAPHICAL INFORMATION SYSTEM AND REMOTE SENSING

COURSE CODE: HE455

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	3	1	50	-	50	25	125	

Course Objectives: The main objectives of this course are to provide the students with fundamental concepts of Geographic Information Systems (GIS) and familiarize with GIS software. Database development, manipulation and spatial analysis techniques for information generation will be taught.

1. Introduction (4 hours)
   - 1.1. Information systems
   - 1.2. The philosophy of GIS
   - 1.3. History of GIS
   - 1.4. Definition and need of GIS
   - 1.5. Components of GIS
   - 1.6. GIS and cartography
   - 1.7. Vector representation
   - 1.8. Different types of data
   - 1.9. Data processing steps
   - 1.10. Function of GIS and its applications

2. Spatial Data Model (5 hours)
   - 2.1. GIS spatial elements
   - 2.2. Concept of data model
   - 2.3. Raster data model
   - 2.4. Vector data model
   - 2.5. Topology
   - 2.6. Vector and 3-D

3. Data Capture and Automation (5 hours)
   - 3.1. Importance of data
   - 3.2. Source of data
   - 3.3. Capture from analog map by GEOCODING
   - 3.4. Field data collection
   - 3.5. Alternative data entry methods
   - 3.6. Attribute data
   - 3.7. Editing and validation
   - 3.8. Coordinate system
   - 3.9. Map projection
   - 3.10. Accuracy and precision

4. Database Concept and Design (6 hours)
   - 4.1. Databases concepts and components
   - 4.2. Database processing and management systems
   - 4.3. Database design
   - 4.4. Data dictionary

5. Spatial Analysis (6 hours)
   - 5.1. Spatial interpolation methods
   - 5.2. Raster methods including topological overlays
   - 5.3. Map calculations
   - 5.4. Statistics
   - 5.5. Integrated spatial analysis

6. Surface Model: DEM; Slope; Aspect; other Raster Functions, (3 hours)

7. River Network Analysis: (4 hour)
   7.1 Flow direction; flow accumulation; river network; and watershed boundary delineation.

8.GPS (4 hours)
   8.1. Basic concept of GPS and its application
   8.2. Working principles of GPS
   8.3. Introduction of DGPS
   8.4. Error in GPS

9. Remote Sensing (4 hours)
   9.1. Basic concept of remote sensing
   9.2. Electromagnetic spectrum and windows
   9.3. Spectral signature of different land use
   9.4. Introduction to different satellites
   9.5. Resolutions in remote sensing
   9.6. Application of remote sensing

10. Making Maps (4 hours)
   10.1. Map function in GIS
   10.2. Map design
   10.3. Map elements
   10.4. Choosing the map type
   10.5. Exporting map in different format printing a map

Tutorials and Practical:

1. Spatial database development
2. Linking non-spatial and spatial database
3. Projection
4. Database editing and uploading
5. GPS data and integration in GIS
6. Geo processing
7. Spatial analysis
8. River analysis
9. Map layout
10. Mini-project for GIS application

Reference books:

1. J. Star, and J. Estes, "Geographical Information Systems: An Introduction", Prentice Hall, Englewood Cliffs, N.J.
2. J. Lee, and D.W.S. Wong, "Statistical Analysis with Arc View GIS", John Wiley and Sons, Inc., New York
3. P.A. Burrough, and R.A. McDonnell, "Principles of Geographical Information Systems", Oxford University Press, USA.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	4	4
2	5	6
3	5	6
4	6	6
5	6	6
6	3	2
7	4	5
8	4	4
9	4	6
10	4	5
Total	**45**	**50**

* There may be minor variation in marks distribution

ROAD ENGINEERING

COURSE CODE: HE456

Year: III

Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objectives: The main objectives of this course are to provide the students with concepts of design the elements of highway geometry, typical road construction technology and practices in Nepal geographical and geological constraints. Students can design the flexible and rigid road pavement by following IRC method.

1. Introduction to Transportation Planning and Engineering (3 hours)
   - 1.1. Introduction
   - 1.2. Modes of Transportation
   - 1.3. Comparison between Various Modes of Transportation
   - 1.4. Historical Development of Roads and Road Construction in Nepal
   - 1.5. Transport Planning including Objective of Road Planning, National Network Planning, Urban Road Network Planning and Ring Roads
   - 1.6. Classification of Roads (NRS)
2. Highway Alignment and Engineering Survey (3 hours)
   - 2.1. Introduction
   - 2.2. Requirements of Highway Alignment
   - 2.3. Factors Controlling Highway Alignment
   - 2.4. Engineering Survey and its Stages
   - 2.5. Structure of the Route Location Process
   - 2.6. Physical Surveys: Map Study, Reconnaissance, Preliminary and Detailed Surveys
3. Geometric Design of Highway (12 hours)
   - 3.1. Definition and Scope of Geometric Design
   - 3.2. Basic Design Controls and Criteria for Design
   - 3.3. Elements of Cross-section
   - 3.4. Elements of Horizontal Alignments: Tangents, Circular curves and transition curves
   - 3.5. Design of horizontal alignment and super elevation
   - 3.6. Horizontal sight distance based on stopping and on passing
   - 3.7. Elements of Vertical Alignment: Tangent vertical curves and gradient
   - 3.8. Design of vertical alignment: vertical curve over crest and in sag
   - 3.9. Recommendations for alignment designs and coordination of horizontal and vertical alignments
   - 3.10. Introduction to road intersections
4. Highway Drainage (5 hours)
   - 4.1. Importance of highway drainage
   - 4.2. Surface drainage and estimation of water quantities
   - 4.3. Classification of highway drainage structures and design of drainage components
   - 4.4. Erosion control and energy dissipating structures
   - 4.5. Other miscellaneous cross drainage structures
   - 4.6. Subsurface drainage: drainage of infiltrated water, control of seepage flow, and lowering water table
   - 4.7. Subsurface drain: diameter of pile and its performances, slope of pile, manholes etc.
5. Highway Materials (6 hours)
   - 5.1. Classification of materials: mineral materials, binding materials and materials for general construction purposes
   - 5.2. Types of aggregated and tests on their gradation, strength, durability etc.
   - 5.3. Binding materials and their classification: natural bitumen, petroleum bitumen, penetration emulsions, road tar, etc.
   - 5.4. Tests on binders: Consistency test, composition test etc.
   - 5.5. Bitumenous mixers and asphalt concrete: open graded mixes and dense graded mixers
   - 5.6. Design of bituminous mixers and optimum binder content.
6. Hill Roads (5 hours)
   - 6.1. Introduction
   - 6.2. Special Consideration in Hill Road Design
   - 6.3. Alignment of Hill Road Design: Ceneral Consideration, Route Location in Hills, Cradient, Design and Types of Hair Pin Bends, Different Types of Hill Road Cross Sections
   - 6.4. Special Structures in Hill Road
     - 6.4.1. Types of Retaining Structures, River Training Structures, Land Slide Stabilization Structures and Gully Control Structures
   - 6.5. Bioengineering structure for slope protection and drainage
   - 6.6. Road construction practice in Nepal
7. Road Pavement (6 hours)
   - 7.1. Definition and types of pavements

7.2. Differences between flexible and rigid pavement structures
7.3. Loads and other factors controlling pavement
7.4. Design methods for flexible pavements
7.5. Details of the IRC method of design of flexible pavements
7.6. Design methods for rigid pavements and Westergaard's theory
7.7. Stresses due to load, temperature differential and subgrade friction
7.8. Details of the IRC and NRS method of design of rigid pavements for highways

8. Road construction technology (5 hours)
   8.1. Method of construction of road construction
   8.2. Construction Earthen Road
   8.3. Construction of Gravel Road
   8.4. Construction of Bituminous Pavement
   8.5. Construction of Cement Concrete Pavement
   8.6. Road Maintenance

Tutorial:
There shall be related tutorials exercised in class and given as regular homework exercises.

Practical:

1. Los Angeles Abrasion Value and Crushing Value of Aggregates
2. Penetration Value; Viscosity; Softening Point and Ductility of Bitumen
3. Skid Resisance Test on Road Surface
4. Marshall Stability Test and Asphalt Mix Design
5. Extraction of Bitumen from Mix and Gradation of Aggregate after Extraction

References:

1. S.B.Sehgal and K.l. Bhanot, "A Text-book on Highway Engineering and Airports", S. Chand and Co. Publishers Ltd., New Delhi
2. S.K. Sharma, "Principles, Practice and Design of Highway Engineering", S. Chand and Co. Publishers Ltd., New Delhi
3. Dr. S.K. Khanna and Dr. C.E.CJusto, "Highway Engineering' Nem Chand & Bros Roorkee (U.P.)
4. C.A. Flaherty, "Highway Engineering' Edward Arnold (Publishers) Ltd.
5. P.M- Parajuli, "Course Manual on Transportation Engineering' Department of Civil Engineering, Pulchowk Campus

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	3	4
2	3	4
3	12	12
4	5	5
5	6	6
6	5	5
7	6	5
8	5	5
Total	**60**	**50**

* There may be minor variation in marks distribution

ELECTRO-MECHANICAL EQUIPMENT

COURSE CODE: HE457

Year: III

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	3	1	50	-	50	25	125	

This course presents the theoretical and practical concept of electromechanical equipments, systems and their control including components operating principle, electrical schematic diagrams. This course will provide the knowledge of principles and application of rotating and non-rotating electromechanical energy converting equipment.

Course contents:

1. Principles of Electromechanical energy conversion (11 hours)
   - 1.1 Introduction
   - 1.2 Magnetic Circuits
   - 1.3 Series and parallel magnetic circuits
   - 1.4 Core with air gap
   - 1.5 B-H relationship (Magnetization Characteristics)
   - 1.6 Hysteresis with DC and AC excitation
   - 1.7 EMF induced in a coil rotating in a magnetic field
   - 1.8 Forces and torques in magnetic field systems
   - 1.9 Electromagnetic Torque, Reluctance torque
   - 1.10 Energy balance, energy flow and coupling field reaction in electro mechanical system
   - 1.11 Singly and doubly excited magnetic field system

2. Construction operating characteristic and application of DC generator (6 hours)
   - 2.1 Types of dc generator, characteristics and EMF equations, generator performance curve, causes of failure to build up voltage, voltage regulation and efficiency.
   - 2.2 Parallel operation of DC generators.

3. Three Phase Synchronous Machine (10 hours)
   - 3.1 Three phase Synchronous Generator:
     - 3.1.1 Construction details, armature and field windings, rotor types and excitation systems.
     - 3.1.2 Working principle
     - 3.1.3 Emf equation, distribution factor and pitch factor
     - 3.1.4 Armature reaction and its effects
     - 3.1.5 Alternator with load and its phasor diagram
   - 3.2 Three phase synchronous motor
     - 3.2.1 Principle of operation
     - 3.2.2 Starting methods
     - 3.2.3 No load and load operation, phasor diagram
     - 3.2.4 Effect of excitation and power factor control
   - 3.3 Parallel operation ofalternators
     - 3.3.1 Synchronization condition and requirement
     - 3.3.2 Load sharing by parallel units
4. Induction Machine (8 hours)
   - 4.1 Three-phase induction motors. Principle of operation, construction, types. Rotating magnetic field, emf equation of an AC Machine, torque developed in an induction motor, equivalent circuit model, torque-speed characteristics, starting & speed control.
   - 4.2 Three phase Induction Generator
     - 4.2.1 Working principle, voltage buildup in an induction Generator
     - 4.2.2 Power stages

5. Fractional Kilowatt Motors (10 hours)
   - 5.1 Single phase induction motors
     - 5.1.1 Construction and Characteristics
     - 5.1.2 Double field revolving theory
   - 5.2 Split phase induction motor
     - 5.2.1 Capacitor start motor
     - 5.2.2 Capacitor start and run motor
     - 5.2.3 Shaded pole motor
     - 5.2.4 Reluctance start motor
   - 5.3 Universal Motors
   - 5.4 Special purpose motors

5.4.1 Stepper motor
5.4.2 Servo motor

Practical

1. Calculation of voltage regulation and efficiency DC Generator
2. No load and Load characteristic of Synchronous Generator
3. Calculation of voltage regulation and efficiency Synchronous Generator.
4. Parallel operation of synchronous generator using synchroscope.
5. Torque slip characteristic of induction motor.
6. To study the effect of a capacitor on the starting and running of a single-phaseinduction motor

Text Book:

1. "Electrical Technology II" , J B gupta, kottaria and sons

Reference Book

1. "Electric machine", J Bgupta, kottaria and sons
2. S. Baral, "Fundamental of HydropowerEngineering", Engineering and Education Service Pvt.Ltd. Kathmandu.
3. B.L Theraja, A.K. Theraja , A textbook of electrical engineering, S. Chand company.
4. M.M. Dandekar and K.N. Sharma, "Water Power Engineering",Vikash Publications House Pvt.Ltd, India

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below

Chapter	Hours	Marks Distribution*
1	11	10
2	6	8
3	10	12
4	8	10
5	10	10
Total	45	50

* There may be minor variation in marks distribution

SURVEY CAMP

COURSE CODE: HE458

Year: III

Semester: I **(Field work: 12 days)**

Teaching Schedule			Examination Scheme				Total Marks	Remarks
Hours/ Week			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
1	2	-	-	50	-	50	100	

Course Objectives: The basic objective of the course to give the students an ample opportunity to consolidate and update their practical and theoretical knowledge in surveying, in the actual field conditions and with practical problems.

A) Horizontal Control Practices for Large Area (Major and Minor Traverse):
For this purpose at least 1.4 km periphery area shall be enclosed by forming the closed traverse and coordinates of those traverse points shall be controlled with reference to national grid system. X and Y coordinates shall be controlled by Theodolite/Total Station. Detailed topographic survey shall be conducted within the perimeter of the semi built up area around 4.0 to 6.0 hectares of land (about 5-7 control points).
Time Allocated: 5 Days (including reconnaissance, stations selection and pegging of major traverse, minor traverse, major traverse angles, distances measurement, etc.)

B) Vertical Control for Major and Minor Traverse:
Coordinates (Z) of these traverses shall be controlled by using Auto level. Link traverse exercise must be compulsory. Time Allocated: 2 Days

- 1 Day for fly leveling and RL transfer
- 1 Days for computation and plotting of traverse

Vertical control for control points shall be done by fly leveling and detailing shall be done by using Total Station and Theodolite. Data saving in data logger (Electronics field book) and manual booking both should be practices in detailing.

C) Bridge Site Survey or river crossing survey:
Detailed topographic survey of suitable bridge site area (180m X 110m) shall be conducted by which Topographic map, L- section, X section etc shall be prepared at standard scale.
Time Allocated: 1 Days
Detailing shall be done by using total station. Vertical control for control points shall be done by auto level.

D) Road Alignment Survey:
At least 800m road alignment survey shall be done from where plan, L section, X section etc shall be drawn at standard scale including selection of grades and formation levels etc.
Time Allocated: 1 Days

E) Hydropower station Site Survey:
Detailed topographic survey of suitable hydropower site area shall be conducted by which Topographic map, L-section, X section etc shall be prepared at standard scale.

1. Topographical Survey
    a. Dam Site
    b. Reservoir Area Survey
    c. Survey for Power Channel
    d. Survey for tunnel
    e. Project area map (scale 1:5000)
2. Construction material survey
3. Hydrologic Survey

Time Allocated: 3 Days

Requirements:

The number of students for each group should not be more than 6 (six) and modern surveying equipment are to be used as far as possible.

Evaluation Criteria:

Internal Evaluation: Regular evaluation throughout the 12 days as well as viva for computation and plotting of major traverse, minor traverse, viva for hydropower, road and bridge site survey and traverse orientation check should be taken.

External Evaluation: Standard Reports shall be prepared group wise. During compilation of the report, data shall be submitted content wise and all the reference sketches and standard drawings shall be compiled in A3 size and all the original data and drawings shall be presented during final viva.

B.E. (HYDROPOWER) THIRD YEAR DETAIL SYLLABUS

(SECOND SEMESTER)

DESIGN OF STEEL STRUCTURES

COURSE CODE: HE461

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	0	2	50	-	50	0	100	

Course Objective: Main objective of this course is to make students able to design basic structural elements of steel structures in Limit State Design Method.

1. Introduction (2 hours)
1.1 Comparison of steel structures with RCC structures
1.2 Limit state design method
1.3 Characteristic and design strength of steel
1.4 Materials and Specification
1.5 Types of loads and load combinations

2. Analysis and Design of Joints (5 hours)
2.1 Introduction to riveted, bolted, pinned and welded joints
2.2 Types of bolted and welded joints
2.3 Failure mode of riveted, bolted and welded types of joints
2.4 Efficiency of joints
2.5 Codal provisions for design
2.6 Design of bolted, riveted and welded joints for axial
2.7 Design of joints for eccentric load: subjected to torsion and shear, tension and shear

3. Design of Compressive Members (6 hours)
3.1 Classification of cross-sections
3.2 Determination of permissible stress for compressive members
3.3 Euler column buckling
3.4 Effect of residual and initial imperfections
3.5 Design of compressive members with standard sections
3.6 Design of one component, two components and built up members for axial load
3.7 Design of lacing and batten plates
3.8 Design of eccentrically loaded columns
3.9 Different types of column bases: Slab Base , Gusseted Base, Connection details
3.10 Design of steel poles

4. Design of Tensile Members (6 hours)
4.1 Behavior and net cross section area of tension members
4.2 Net cross-are of tension members
4.3 Modes of failure
4.4 Design of standard section members in tension
4.5 Design of eccentrically loaded tension members
4.6 Design of steel ties
4.7 Design of lug angles
4.8 Design criteria and introduction of transmission tower

5. Design of Beams (7 hours)
5.1 Classification of beams
5.2 Failure mode of beams
5.3 Flexural design of beam
5.4 Effect of holes in tension zone
5.5 Lateral torsional buckling
5.6 Shear strength of beams
5.7 Web buckling and web crippling
5.8 Deflection
5.9 Design of purlins
5.10 Design of pivoted beam of gate of reservoir

6. Design of Plate Girders (7 hours)
6.1 Introduction to plate girder
6.2 Shear buckling resistance of web
6.3 Design of end panels
6.4 Anchor forces
6.5 Different types of stiffeners (Intermediate transverse web, Load carrying, bearing, torsional horizontal etc.)
6.6 Detail design of plate girder

7. Design of Roof Truss (6 hours)
7.1 Loads in different buildings

7.2 Analysis of truss
7.3 Configuration of truss
7.4 Truss members and connections
7.5 Detail design of trusses

8. Design of transmission towers (6 hours)
8.1 Introduction, types of transmission towers
8.2 Analysis of transmission towers
8.3 Design of transmission towers
8.4 Load Analysis in truss/tower

References:

1. N.Subramanian, "Design of Steel Structures: Theory and Practice", Oxford university Press, U.S.A, Third Edition, 2011
2. Duggal.S.K, "Design of Steel Structures", McGraw Hill New Delhi, 2010 .
3. Dayaratnam P. "Design of Steel Structures," S. Chand Limited, New Delhi. 2008
4. John E. Lothers, "Structural Design in Steel", Prentice Hall, 1999
5. Neal. B.G., "Plastic Method of Structural Analysis", Taylor & Francis, Third Edition, 1985
6. Edwin.H.Gaylord, Charles.N.Gaylord, James. E. Stallmeyer, "Steel Structures", McGraw Hill, New Delhi, 1980.
7. Ramchandra, "Design of Steel Structures", Vol I & II Standard Book House, Delhi, 1975
8. Arya.S and Ajmani.J.L, "Design of Steel Structures", Nem Chand & Bros, Roorkee

Evaluation scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	2	2
2	5	4
3	6	6
4	6	8
5	7	9
6	7	9
7	6	6
8	6	6
Total	**45**	**50**

* There may be minor variation in marks distribution

DESIGN OF HYDRAULIC STRUCTURES

Course code: HE462

Year/Part: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
4	-	2	50		50		100	

Course Objectives: The course would cover the design aspects of the hydraulic structures meant for storage, diversion, conveyance and distribution of water apart from structures for river flow modification and control. Preliminary design aspects of hydropower structures would also be included. Foundation considerations in the design of the structures would be discussed for each.

1. Introduction (3 hours)
   - 1.1. Storage structures
   - 1.2. Diversion structures
   - 1.3. Conveyance and distribution structures
   - 1.4. Reservoirs behind dams and pond area behind barrages
   - 1.5. Determination of capacities (influence of sedimentation)
   - 1.6. Dead and Live storages
2. Design of storage structures (8 hours)
   - 2.1. Gravity dam
   - 2.2. Spillway
   - 2.3. Non-overflow sections and their design
   - 2.4. Concrete dam detail, joints, waterer seal, galleries, audit and sluices
   - 2.5. Foundation treatment for concrete dams (curtain and, consolidation grouting)
   - 2.6. Other types of concrete dams general design criteria's
     - 2.6.1. Arches
     - 2.6.2. Buttress
     - 2.6.3. Hollow
3. Types of spillways/ Types of energy dissipaters (4 hours)
   - 3.1. Adaptations for concrete and embankment dams
   - 3.2. Flow characteristics of gated/ungated spillways / breast- walled gates.
   - 3.3. Hydraulic Jump / Ski-Jump
   - 3.4. Roller bucket
   - 3.5. Influence of tail water rating curve on choice of energyDissipater
4. Earth and rock fill dam (5 hours)
   - 4.1. Introduction of rock fill dam
   - 4.2. Typical section of rock fill dam
   - 4.3. Considerable parameters of rock fill dam
   - 4.4. Introduction and types of earth fill dam
   - 4.5. Suitability and criteria for the selection of earth fill and rock fill dam
   - 4.6. Analysis and design of embankment dam/ rock and earth fill
5. Types of gates for dam and barrage structures (2 hours)
   - 5.1. Radial gates
   - 5.2. Lift type gates
   - 5.3. Design consideration of gates in structures
6. Diversion structures (6 hours)
   - 6.1. Barrage and weir on permeable foundation
   - 6.2. Design consideration of barrages for surface and sub surface flows
   - 6.3. Raft foundation on alluvial rivers
   - 6.4. Retrogression and flow concentration effects on barrage design
   - 6.5. Design consideration of barrages (gravity design on boulder bed rivers
   - 6.6. Sedimentation characteristics for barrage ponds and its influence by gate operation
   - 6.7. Management of sedimentation in barrage ponds
   - 6.8. Barrage components: Glacis, Rigid apron, Flexible (concrete block) apron
7. Canal structures/cross drainage structures design (6 hours)
   - 7.1. Components of canal system
   - 7.2. Head regulator, Cross regulator and falls
   - 7.3. Canal section design (unlined and lined); in cutting and filling
   - 7.4. Canal capacity determination
   - 7.5. Components of cross drainage structures
   - 7.6. Types of cross drainage structures
   - 7.7. Suitability of cross drainage structures
   - 7.8. Aqueducts; Super passage; Syphon Aqueducts.
8. Design of auxiliary structures (6 hour)
   - 8.1. Theory and hydraulic design of Culverts
   - 8.2. Structures for prevention of riverbank erosion (considerations for toe scour; provision of filter to prevent subsidence)
   - 8.3. Guide bunds for flow control of rivers (for barrages and bridges)
   - 8.4. Design features of guide river control system/bunds

9. Design of Settling basin (4 hours)
   9.1. Concept of particle settling
   9.2. Design principal of settling basin
   9.3. Efficiency of Settling basin

10. Design of forebay and surge tank (4 hours)
   10.1. Function of forebay and surge tank
   10.2. Design principal
   10.3. Calculation of surge
   10.4. Surge tank and its type

11. Design of Penstock pipe (4 hours)
   11.1. Stresses in penstock pipe
   11.2. Economic size of penstock
   11.3. Types of penstock pipe and their design

Reference books:

12. Hydraulic structures, P Novak, A. I. B. Moffat, C. Nalluri and R Narayanan, Taylor and Francis, U. K
13. Hydraulics of Spillways and Energy Dissipaters, R. M. Khatsuria, Marce Dekker Publishing, New York
14. Manual on Barrages and Weirs on Permeable Foundation, Publication 179, (Volumes I and II), Central Board of Irrigation and Power, New

Evaluation scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	4	4
2	3	3
3	6	6
4	3	4
5	6	8
6	3	4
7	4	4
8	8	8
9	5	5
10	3	4
Total	**45**	**50**

* There may be minor variation in marks distribution

PUMPS AND TURBINES

COURSE CODE: HE463

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	0	100	

Course Objectives:

To provide the knowledge of basic principles, governing equations, characteristics and design of pumps and turbines that is useful for hydropower sector.

Learning Outcomes and Competences:

Understand the role of pumps and turbines as energy conversion devices.
Match the pump and system characteristics.
Design different types of pumps and turbines.
Know the concept of cavitations and erosion in pumps and turbines.

Course Contents:

1. Introduction (6 hours)
- 1.1 Definitions: Unit quantities, head, specific speed, power, efficiency
- 1.2 Classification of pumps and turbines
- 1.3 Operating principles and component in pumps and turbines
- 1.4 Structures of pumps and turbines
- 1.5 Dimensional analysis and similarity

2. Transfer of energy in pumps and turbines (8 hours)
- 2.1 Fluid flow through pumps and turbines
- 2.2 Velocity vector diagrams
- 2.3 Conservation of Momentum
- 2.4 Euler equation for pumps and turbines
- 2.5 Effect of impeller vane angle, guide vane and runner blades angles

3. Basic design of pumps and turbines (15 hours)
- 3.1 Velocity Triangles: Pelton, Francis, Kaplan turbines and Centrifugal pump
- 3.2 Bucket dimensions for Pelton Turbine
- 3.3 Runner shapes for different blade speeds
- 3.4 Draft tube functions and types
- 3.5 Design of Pelton, Francis and Kaplan Turbines and Centrifugal pump
- 3.6 Selection of appropriate hydro turbine

4. Performance of Pumps and Turbines (8 hours)
- 4.1 Performance curves of pumps and turbines
- 4.2 Energy losses in pumps and turbines
- 4.3 System characteristics, turbine and pump selection procedures
- 4.4 Operating point for different pumps system
- 4.5 Pumps in parallel and in series

5. Cavitation and Erosion in pumps and turbines (8 hours)
- 5.1 Definitions: Suction lift, Net positive suction head, cavitation, erosion
- 5.2 Causes, effects and prevention of cavitation, cavitation index
- 5.3 Sediment erosion in hydro-turbines in Nepal
- 5.4 Effect of sand erosion on pumps and turbine components and its consequences
- 5.5 Prevention techniques and methods of hydro-turbines by erosion

References:

1. Munson, Young and Okiishi's . Fundamentals of Fluid Mechanics. 8th Edition.
2. L. Hamill. Understanding Hydraulics. Palgrave Macmillan; 2nd edition.
3. M. Manohar, and P. Krishnamachar, “Hydraulic Machinery & Advanced Hydraulics”, Vikas Publishing House PVT LTD, New Delhi.
4. Wright, T., Fluid Machinery – Performance, Analysis, and Design, CRC Publication, New York, 1999.
5. Kristine Gjøsæter. Hydraulic Design of Francis Turbine Exposed to Sediment Erosion. Master Degree Thesis, NTNU, 2011.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below

Chapter	Hours	Marks Distribution*
1	6	6
2	8	10
3	15	18
4	8	8
5	8	8
Total	**45**	**50**

* There may be minor variation in marks distribution

POWER SYSTEM APPARATUS

Course code: HE464

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	3	1	50	-	50	25	125	

Course Objective:
To present fundamental knowledge and operational skills on
- Methods and instruments for measurement of electrical quantities
- Electrical equipment used in power generating plant
- Protection system and its associated components in power system

Contents

1. Measurement of Electrical Quantities (8 Hours)
- 1.1 Electrical Measurement Devices
  - 1.1.1 Wattmeter-types and working principles
  - 1.1.2 Energy meter-types and working principles
  - 1.1.3 Frequency meter-types and working principles
  - 1.1.4 Power factor meter-types and working principles
- 1.2 Instrument transformers
  - 1.2.1 CT and PT
- 1.3 Auto transformers

2. General consideration (4 Hours)
- 2.1 Station electrical services
- 2.2 High pressure oil supplies for lubrication and control system operation
- 2.3 Busbar arrangement

3. **Control of Hydro Generating System** (6 Hours)
- 3.1 P-f and Q-V control loop of hydro generating system
- 3.2 Fundamentals of speed governing, different types of governors
- 3.3 Generator response to load change
- 3.4 Different types of Excitation systems

4. Power System Protection (15 Hours)
- 4.1 Protection components, basic requirement of protection scheme
- 4.2 Fuse
  - 4.2.1 Fuse element, rated fuse current, minimum fusing factor, fusing factor, pre arcing and arcing time
  - 4.2.2 Types of fuses: Construction, operating characteristic, application and merits and demerits
- 4.3 Isolators and Contactors
  - 4.3.1 Isolators: construction and operation
  - 4.3.2 Contactors: construction and operation, normally open (NO) and normally closed (NC), auxiliary contacts of contactors, and application of contactors
- 4.4 Circuit breakers
  - 4.4.1 Circuit breaking process: arc phenomena, arc extinction and its methods, duties of circuit breakers
  - 4.4.2 Construction, operating principle and application of various types of circuit breakers – MCB, MCCB, ACB, OCB, VCB, SF_6 CB
  - 4.4.3 Circuit breaker rating: Rated voltage, rated current, rated frequency, operatingduty, making capacity, short -time rating.
  - 4.4.4 Testing of circuit breakers.
- 4.5 Protective relays
  - 4.5.1 Introduction and classification of relays
  - 4.5.2 Method of earth fault detection
  - 4.5.2 Different types of relays:
    Electromagnetic Relays, Buchholz Relay

5. **System Earthing** (6 hours)
- 5.1. Over voltage protection: Overhead earth wire, angle of protection, horn gap and rod gap lightning arrestor, surge absorbers
- 5.2. Earthing: Definition, purpose, system earthing and body earthing, methods of earthing, substation earthing, measurement of soil resistivity.

6. **Introduction of Substation Equipment** (6 hours)
- 6.1 Firefighting system in power station
- 6.2 Power Line Carrier Communication (PLCC)
- 6.3 PLC Application
- 6.4 Supervisory Control and Data Acquisition (SCADA) System

Practical:

1. Measurement of Electrical Quantities in Actual Applications
2. Mini hydro Unit Control
   - Start up and synchronize to system bus
   - Study power and var control of the unit while synchronized and delivering energy to the system
3. Field trip to generating plant
   - visit a full size operating generating plant
   - study the specific component and its operating mechanism of the visited power plant
   - Prepare a formal report on power plant installation describing specific major component
4. Measurement of soil resistivity and design an earthing system

References:

1. P.C. Sharma “Power Plant Engineering”
2. S.C. Arora, S. Domkundwar“ A course in power plant Engineering”
3. J.B Gupta “Switchgear and protection” Kataria and Sons
4. A.K. Sawhney, "A Course in Electronic Measurement and Instrumentation " Dhanpat Rai and Sons,1988
5. Hadi Sadat “Power System ”
6. P.Kundur “Power System Stability and Control” Mc Graw Hill Inc

Evaluation scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	8	8
2	4	5
3	6	7
4	15	18
5	6	6
6	6	6
Total	**45**	**50**

* There may be minor variation in marks distribution

ENGINEERING ECONOMICS

COURSE CODE: HE465

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	1	50	-	50	-	100	

Course Objectives: The objective of the course is to make students able to conduct simple economic studies. They will alsobe able to make evaluation of engineering projects and make decisions related to investment.

1. Introduction to Engineering Economics (3 hours)
   1.1. Origin of engineering economy
   1.2. Principles of engineering economy
   1.3. Role of engineers in decision making
   1.4. Notation and cash flow diagram.

2. Cost Classification and Analysis (3 hours)
   2.1. The elements of cost
   2.2. Classification of cost: overhead cost, prime cost
   2.3. Cost variance analysis
   2.4. Job and process costing

3. Interest and Money-Time Relationships (6 hours)
   3.1. Introduction
   3.2. Simple interest
   3.3. Compound interest(nominal interest rate, effective interest rate and continuous compounding)
   3.4. Economic equivalence
   3.5. Development of interest formulas

4. Methods of Engineering Economic Analysis (8 hours)
   4.1. Determining minimum attractive rate of return (MARR).
   4.2. Payback period method
   4.3. Equivalent worth methods(present worth method, future worth method and annual worth method)
   4.4. Rate of return methods(internal rate of return method and external rate of return method)
   4.5. Benefit cost ratio method
   4.6. Financial and economic analysis

5. Analysis of Alternatives (6 hours)
   5.1. Comparison of mutually exclusive alternatives having same useful life(payback period method and equivalent worth method, rate of return methods and benefit cost ratio method)
   5.2. Comparison of mutually exclusive alternatives having different useful lives(repeatability assumption, co-terminated assumption and capitalized worth method)
   5.3. Comparing mutually exclusive, contingent and independent projects in combination.

6. Cost/Benefit Analysis (3 hours)
   6.1. Conventional cost/benefit ratio
   6.2. Modified cost/benefit ratio
   6.3. Break-even analysis

7. Risk Analysis (6 hours)
   7.1. Introduction
   7.2. Methods of describing project risks.
      7.2.1. Sensitivity analysis
      7.2.2. Scenario analysis
   7.3. Projects operating under conditions of certainty and uncertainty
   7.4. Decision tree and sequential investment decisions

8. Depreciation and Income Taxes (6 hours)
   8.1. Depreciation concept and terminology
   8.2. Methods of depreciation(straight line method, declining balance method, sinking fund method, sum of the year digit method and modified accelerated cost recovery system (MACRS))
   8.3. Introduction to income tax.
   8.4. The effective corporate income tax rate.
   8.5. General procedure for making after tax economic analysis.

9. Inflation and Its Impact (4 hours)
   9.1. Concept of inflation.
   9.2. Measuring inflation
   9.3. Equivalence calculation under inflation

9.4. Impact of inflation on economic evaluation

Reference books:

1. Chan S. Park, “Contemporary Engineering Economics”, Prentice Hall Inc, India.
2. J. L. Riggs, D. D. Bedworth, and S.U. Randhawa, “Engineering Economics”,Tata MCGraw Hill Education Private Limited, India.
3. W.G. Sullivan, J. A. Bontadelli, and E.M.Wicks, “Engineering Economy”, Pearson Education Asia, India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution*
1	3	2
2	3	2
3	6	6
4	8	10
5	6	8
6	3	2
7	6	8
8	6	8
9	4	4
Total	**45**	**50**

* There may be minor variation in marks distribution

ROCK MECHANICS AND TUNNELING

COURSE CODE HE466

Year: III

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50		50	25	125	

The aim of this course is to provide knowledge in engineering geology to the students of Hydropower Engineering in the field of hydropower development and to understand how engineering geological parameters play significant role for sustainability of hydropower infrastructures.

1. Rock and Rock Mass (10 hours)
   - 1.1. Physical and mechanical properties of rock
   - 1.2. Properties of rock Mass
   - 1.3. Discontinuities in rock mass
   - 1.4. Shear strength of discontinuities
   - 1.5. Rock stresses: origin of stresses, insitu stresses, induced stresses, influence of tectonics, stress measurement
   - 1.6. Parameters of rock mass classifications
   - 1.7. Rock Mass Classification systems: rock mass rating, Q-system, GSI system
2. Site Investigation/ site selection of different structures (Tunnel, Dam, Canal, Bridge) (7 hours)
   - 2.1. Introduction and purposes of site investigation
   - 2.2. Different stages and phages of site investigation
   - 2.3. Types and Methods of site investigation
   - 2.4. Geophysical exploration
   - 2.5. Geotechnical exploration
3. Tunnel Engineering (10 hours)
   - 3.1. Stability of tunnel, stress induced problem, squeezing and its prediction, design approach
   - 3.2. Tunneling methods; Norwegian tunneling method, new Austrian tunneling method, drill and blast tunnel, tunnel cycle time, bored tunnel
   - 3.3. Tunnel support system; rock support interaction, rock support and reinforcement
4. Geo-hazard (6 hours)
   - 4.1. Hazard, Risk, Danger
   - 4.2. Hazard analysis
   - 4.3. Risk analysis
   - 4.4. Mass movement: Mechanism, classification
   - 4.5. Landslide, classification
   - 4.6. Debris flow
   - 4.7. Seismicity and Earthquake
   - 4.8. Volcanism
5. Rock slope stability analysis (4 hours)
   - 5.1. Factors affecting rock slope instability
   - 5.2. Kinematic analysis: Wedge failure, Plane failure, Toppling Failure
   - 5.3. Rock fall& Rock Slide
6. Analysis and design of components of tunnel system (8 hours)
   - 6.1. Introduction
   - 6.2. Codes and criteria for analysis and design of tunnel lining and tunneling
   - 6.3. Analysis of stresses in tunnel section (longitudinal and cross-sectional)
   - 6.4. Design of temporary lining system in tunnel
   - 6.5. Design criteria of permanent lining and lining materials for tunneling
   - 6.6. Introduction to tunnel analysis and design tools and computer software

Practical:

Following practical exercises will be performed in this course (including two days field study in real project site compulsory)

1. Discontinuity mapping
2. Rock slope failure analyses practice
3. Measurement and analysis of data
4. Stereographic projection
5. Study and preparation of maps
6. Topographical maps
7. Geological maps
8. Preparation & Interpretation of Engineering Geological and geological maps
9. Practical demonstration of Roc-Science software for tunnel designing in computer

References:

Jonson , R.B, Degraff, J.V. " Principles of Engineering Geology", John Wiley and Sons Inc.
Hoek , E. " Rock Engineering" A.A. Balkema Publishers
Deuja, B.B., Dhital , M.R., Wagner, A., Thapa, K.B. " Mountain Risk Engineering Handbook, ICIMOD
Ando, ' Engineering and Hydrogeology" Central Department of Geology, Tribhuvan University
Nilson, B.," Rock Engineering", NTNU, Norway
Upreti, B.N., Dhital, M.R., Landslide Study and Management in Nepal, ICIMOD

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	10	10
2	7	8
3	10	10
4	6	8
5	4	5
6	8	9
Total	**45**	**50**

* There may be minor deviation in marks distribution

ELECTIVE I

COURSE CODE: HE46*

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	1	50	-	50	-	100	

Selection of Elective I:

The main purpose of elective courses is to equip undergraduate students with specialized knowledge and skill:

1. Applied Hydrology
2. Irrigation and Drainage Engineering
3. Environmental Pollution and Management

The course other than above listed can accept by the subject committee and course detail will be presented to the students before the commencement of the course.

APPLIED HYDROLOGY

Course code HE467

Year/Part: III/II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	1	50		50		100	

COURSE OUTLINE

The course aims to put emphasis on application of hydrology focusing on practical approaches with industry-focused applications with the core objective of contributing towards sustainable hydropower. It also aims to stimulate interest of students for higher studies in the areas of water resources in general, and hydropower in particular.

LEARNING OUTCOMES

At the end of this course, students will be able to:

- Enhance knowledge on hydrological principles/process of practical significance
- Advance learning on concepts, techniques, tools, and limitations of hydrologic analysis
- Learn approaches for set-up, calibration, and validation of hydrological models
- Strengthen skills for hydrological characterization for various practical uses

PRE-REQUISITE (if any)

- Basic knowledge in GIS
- Engineering Hydrology

COURSE OUTLINE

1. River Basin Concept [6 hours]

1.1. Hydrological units – river basin, watershed, catchment; stream orders; headwater, mouth, confluence
1.2. Hydrologic principles/processes
1.3. Landscape, weather, climate, climate change, and their controls on hydrology
1.4. River basin- concept and planning approaches, Watershed management concepts

2. Hydrologic Analysis/Characterization [12 hours]

2.1. Rainfall-runoff analysis –for gauged and ungauged conditions
2.2. Components of runoff – overland flow (or surface runoff), lateral flow, groundwater flow
2.3. Hydrograph analysis - component of a hydrograph, factors affecting shape and volume of hydrographs (meteorological factors, physiographic or watershed factors, human factors, etc.); separation of baseflow, unit hydrograph development and applications, SUH,IUH
2.4. Flow duration curve (FDC) – concept, generation, and interpretation/application
2.5. Hydrological procedures for flood routing – linear reservoir routing, Muskingum-Kung routing, etc.
2.6. Environmental flows (E-flows) analysis – definition, importance, and tools for E-flows analysis; concept/ecological metrics of IHA (Indicators of hydrological alterations), Impact on river ecosystem and communities dependent on rivers: fisher folks, rafters, farmers, hydro-developers, irrigators etc.
2.7. Sedimentation analysis– terminologies related to sedimentation, estimation of sediment yield, erodibility, etc. (related to hydrological processes), USLE equation

3. Hydrologic Design [12 hours]

3.1. Measurement of floods – design flood, return period, flood frequency, chance flood, frequency/risk/reliability analysis, probable maximum precipitation (PMP), probable maximum flood (PMF), etc.
3.2. Statistical methods for flood frequency analysis – Log Pearson III method, Gumbel's extreme value Type I method, etc.
3.3. Empirical methods for flood frequency analysis
3.4. Selection of suitable method for flood frequency analysis – goodness of fit, hydrological statistics, etc.
3.5. Dealing the basins with no and/or partial data: Catchment area ratio method, WECS-DHM method, WECS 2018 methods, regional flood frequency analysis, Hydrologic simulation

4. Hydrologic Simulation/Modeling [15hours]

4.1. Introduction/concept to hydrological simulation/modeling
4.2. Types of hydrological models – lumped/distributed, mathematical/conceptual, etc.
4.3. Steps in hydrological modeling
4.4. Model performance evaluation– visual approaches (hydrograph shape, pattern, FDC, etc.), statistical approach (various indicators of model performance evaluation
4.5. Introduction to selected hydrological models – concept, physical processes, applicability, advantages, disadvantages (SWAT, HEC-HMS, TANK, etc.)

4.6. Demonstration of a hydrological modeling and interpretation of modeling results

Project work:

Build a rainfall-runoff simulation model

References:

1. Bras, R. L., and Rodriguez-Iturbe, 1994, "Random Functions and Hydrology", Dover Publications, New York.
2. Chow, V. T., D. R. Maidment, and L. W. Mays; "Applied Hydrology", McGraw Hill International Editions.
3. Haan, C. T., 2002, "Statistical Methods in Hydrology", 2nd ed., Blackwell Publishing, Ames, IA.
4. Hoskings, J. R. M. and J. R. Wallis, 1997, "Regional Frequency Analysis, An Approach Based on L-Moments", Cambridge University Press, New York. Viessman Jr., W., and G. L. Lewis, "Introduction to Hydrology", 4th ed., Harper-Collins, New York, 1996.

Evaluation Scheme:
The question will cover all the subject of the syllabus. The evaluation scheme will be indicated as shown in table below

Chapters	Hours	Marks Distribution
1	6	5
2	12	15
3	12	15
4	15	15
Total	45	50 marks

***Their may be minor variation in marks distribution**

IRRIGATION AND DRAINAGE ENGINEERING

COURSE CODE: HE468

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	1	50		50		100	

Course objective: This course is aimed at training the students specific engineering design consideration for canal irrigation,their operation,maintenance and management with environmental balance and farmer participation in the hills of Nepal.After the completion of the course the student will confidently design the canal and micro irrigation project in the remote Hilly and Terai areas of Nepal.

1. **Chapter 1: Introduction** **(4 hours)**
   - 1.1. Definition advantages and disadvantages of irrigation
   - 1.2. Status and need of irrigation development in Nepal
   - 1.3. Characteristics of Hill irrigation system
   - 1.4. Need potentiality and types of irrigation development in the hills of Nepal.
   - 1.5. Crops their seasons and Periods (Cropping pattern and their intensity)
   - 1.6. Commanded area and Irrigation Intensity
   - 1.7. Method of field irrigation and their suitability
   - 1.8. Planning of irrigation Projects
2. **Chapter 2: Irrigation Water Requirements** **(4 hours)**
   - 2.1. Relation between Duty, Delta and Crop Period
   - 2.2. Crop Water Requirements (Penman's method)
   - 2.3. Operation water requirements
   - 2.4. Water losses due to seepage and irrigation
   - 2.5. Effective rainfall
   - 2.6. Irrigation water requirements
   - 2.7. Soil moisture Irrigation relationship
   - 2.8. Depth and Frequency of Irrigation
   - 2.9. Irrigation efficiencies
   - 2.10. Design discharges for canal
3. **Chapter 3: Canal Irrigation system** **(4 hours)**
   - 3.1. Classification of canals
   - 3.2. Components of canal irrigation system
   - 3.3. Alignments of canals
   - 3.4. Alluvial and Non alluvial canal
   - 3.5. Canal standard and balancing canal depths
   - 3.6. Canal distribution system
4. **Chapter 4: Design of canals** **(6 hours)**
   - 4.1. Design capacity of canals
   - 4.2. Sediment transport in canals
   - 4.3. Tractive force approach for canal design
   - 4.4. Design of stable canals
   - 4.5. Design of alluvial canal and lined canal (Kennedy theory and lacey theory)
5. **Chapter 5: Diversion Headworks** **(8 hours)**
   - 5.1. Components parts of weir /barrage detailed drawing
   - 5.2. Bligh lane and Khosla theory
   - 5.3. Design of sloping glacis weir bay (crest length and thickness of impervious floor)
   - 5.4. Design of undersluice and silt excluder
   - 5.5. Design of silt ejector
   - 5.6. Design of head regulator (crest length and thickness of impervious floor)
6. **Chapter 6: Regulating structure** **(5 hours)**
   - 6.1. Alignment of the off taking channels
   - 6.2. Function of Head regulator, cross regulator, outlet, drop and canal escapes
   - 6.3. Design of regulators and escapes (crest length and thickness of impervious floor)
   - 6.4. Types of outlets, design of pipe outlets
   - 6.5. Types of drops, design of vertical drops (crest length and thickness of impervious floor)
7. **Chapter 7: Water logging and drainage** **(5 hours)**
   - 7.1. Cause effects and preventive measures of water logging
   - 7.2. Water logging and drainage of irrigated land
   - 7.3. Surface drainage system and their design
   - 7.4. Subsurface drainage system and their design

8. **Chapter 8: Sprinkler irrigation** **(3 hours)**
   - 8.1. Advantage and suitability of sprinkler for hill irrigation
   - 8.2. Limitation and disadvantages of sprinkler irrigation
   - 8.3. Types and components of sprinkler system
   - 8.4. Design approach and selection of sprinklers
   - 8.5. Operation and maintenance of sprinkler system
9. **Chapter 9: Drip or trickle irrigation** **(3 hours)**
   - 9.1. Advantage and suitability of drip for hill irrigation
   - 9.2. Limitation and disadvantage of drip irrigation
   - 9.3. Types and components of drip system
   - 9.4. Design approach and selection of drips
   - 9.5. Design of a portable drip system
   - 9.6. Operation and maintenance of drip system
10. **Chapter 10: Planning and Management of Irrigation system** **(3 hours)**
    - 10.1. General irrigation system planning
    - 10.2. Organization and irrigation management
    - 10.3. Operation and maintenance of irrigation systems
    - 10.4. Institutional aspects of irrigation system management
    - 10.5. Introduction to water resource act and customary act

Project work

1. Design a irrigation system

Reference book:

1. BC Punmia, and BBL Pande “irrigation and water power engineering” standard publisher distributors, New Delhi
2. PC Pokhrel "Simple design of hill irrigation project in Nepal"
3. RS varshney, SC gupta, and RL gupta, theory and design of hydraulic structure volume I and volume II
4. SK garg “Irrigation engineering and Hydraulic structure” Khanna Publisher, New Delhi
5. Design manual for irrigation project in Nepal,PDSP manual,M9 Drainage manual
6. Nonconventional irrigation technology project “Manual of drip irrigation technology”, Government of Nepal
7. Nonconventional irrigation technology project “Manual of Sprinkler irrigation technology “Government of Nepal

Evaluation scheme

The question will cover all the subject of the syllabus. The evaluation scheme will be indicated as shown in table below

Marks distribution

Chapters	Hours	Marks Distribution
1	4	4
2	4	5
3	4	5
4	6	8
5	8	8
6	5	8
7	5	3
8	3	3
9	3	3
10	3	3
Total	45	50 marks

***Their may be minor variation in marks distribution**

ENVIRONMENTAL POLLUTION AND MANAGEMENT

COURSE CODE: HE469

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	1	50		50		100	

Course Objectives: To make student able to understand sources, nature, and health effects of air pollutants and basic control strategies and equipment; fundamentals of water pollution; nature of sound and quantification, noise control strategies and solid waste, and basic strategies for proper handling of solid waste.

1. Air pollution (8 hours)
   - 1.1. Introduction to the different aspects of air pollution
   - 1.2. Sources and effects of particulate and gaseous air pollutants
   - 1.3. Photochemical reactions
   - 1.4. Air pollution sampling and measurement
   - 1.5. Measurement of Total suspended particulate, PM10 and PM 2.5
   - 1.6. Industrial dust control methods and equipment
   - 1.7. Selection of particulate control device
   - 1.8. Air quality standards of Nepal
2. Metrological aspects of air pollution dispersion (6 hours)
   - 2.1. Temperature lapse rates, atmospheric stability and inversions
   - 2.2. Dispersion of air pollutants
   - 2.3. The Gaussian plume model
3. Indoor Air Quality (6 hours)
   - 3.1. Indoor Air Pollutants
   - 3.2. Sources of Indoor Pollutants
   - 3.3. Control strategies
   - 3.4. Ventilation standards
   - 3.5. Household smoke pollution and its effects to the residents
4. Water pollution (6 hours)
   - 4.1. Introduction to various aspects of water pollution and water quality standards
   - 4.2. BOD, COD, Oxygen sag curve
   - 4.3. Water quality standards of Nepal
   - 4.4. Municipal waste water treatment systems
5. Solid waste (6 hours)
   - 5.1. Characteristics of solid waste
   - 5.2. Overview of solid waste generation and management techniques
   - 5.3. Hazardous wastes; definition and classification
   - 5.4. Hazardous waste management techniques
6. Noise pollution (6 hours)
   - 6.1. Nature of sound
   - 6.2. Human ear
   - 6.3. Quantification of sound in terms of SPL and PWL
   - 6.4. Typical noise levels at different places and effects of noise
   - 6.5. Noise control methods
7. Global issues and responsible development practices (7 hours)
   - 7.1. Brief history of human civilization and development
   - 7.2. Ozone depletion
   - 7.3. Control of ozone depleting substances in Nepal
   - 7.4. Causes and effects of greenhouse gases
   - 7.5. Indigenous system of natural resource management-land, water, forest, air etc
   - 7.6. Sustainability of eco systems and the need for responsible development practices.
   - 7.7. Environmentally responsible construction
   - 7.8. Education in Human Values (EHV)
   - 7.9. Introduction to Clean Development Mechanism (CDM) and carbon trading

Project work:

1. Measurement of particulate level in different rooms by low volume air sampler

2. Study visits to municipal solid waste management stations

References:

1. Mackenzie L. Davis & David A. Cornwell, “Introduction to Environmental Engineering”, McGraw Hill.
2. Gilbert M. Masters, Standford University, “Introduction to Environmental Engineering and Science”, Printice Hall.
3. Stephan Konz, Kansas State University, “Work design”, Grid Publishing Inc., Colombus, Ohio
4. C. S. Rao, “Environmental Pollution Control Engineering”, New age International (P) Limited, Publishers, India.

Evaluation Scheme

There will be questions covering all the chapters of the syllabus. The evaluation scheme will be indicated in the table below:

B.E. (HYDROPOWER) FOURTH YEAR DETAIL SYLLABUS

(FIRST SEMESTER)

HYDROPOWER PROJECT- I

COURSE CODE: HE471

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
1	6	-	-	50	-	50	100	

Course Objective: The objective of the project work is to equip the students with skills required to synthesize comprehensively the knowledge gained during the course of study for a practical application of hydropower engineering discipline in real life. Under the supervision and guidance of member/members of faculty each student is required to carry out an individual or group project which provides opportunities for tackling problem to hydropower engineering and is required to submit a project report.

The choice of project will depend upon the interest of student/students, faculty and the facilities available in the campus.
A project may involve:

1. Preparation of a design for an expensive hydropower Engineering project
2. Preparation of a Dissertation involving a literature survey, and a correlation of existing knowledge
3. An experimental investigation

The project work is defined into two parts, viz. Project I and Project II. In Project I students are required to complete following works for aforementioned categories of project works:

1. Design type project
   - 1.1. Background
   - 1.2. Project Description
   - 1.3. Study Area
   - 1.4. Literature Review/Guidelines etc.
   - 1.5. Methodology
   - 1.6. Field data collection and plotting
2. Dissertation type project
   - 2.1. Background
   - 2.2. Need of the Research
   - 2.3. Objectives and scope of the work
   - 2.4. Literature Review
   - 2.5. Area of Study
   - 2.6. Methodology
   - 2.7. Data Collection and Compilation
3. Experimental type project
   - 3.1. Background
   - 3.2. Objectives and Scope of the Work
   - 3.3. Literature Review
   - 3.4. Current State of Technology and Need of the Research
   - 3.5. Experimental Setup
   - 3.6. Methodology
   - 3.7. Data Collection and Compilation

At the initial phase, the faculty may conduct a number of lectures and discussions as to the approach of the project. In the later phase, the student will be left on his/their won to pursue his/their work and to consult the faculty whenever any problem crops up. The student/s should then submit a draft report, prior to the final report, so that the supervisor can review the work, and correct the mistakes, if necessary. The final draft of the report of the report shall be submitted to the Head of Department in duplicate.

DESIGN OF REINFORCED CEMENT CONCRETE (RCC) STRUCTURES

COURSE CODE: HE472

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
4	1	2	50		50	25	125	

Course Objective: Main objective of this course is to make students able to design basic structural elements like slab, beam, column, footing and staircase as well as pre-stressed structural elements in order to make their base for designing hydraulic structures.

1. Introduction to RCC Structures (4 hours)
   - 1.1. Limitation of plain concrete
   - 1.2. Concept of RCC structures
   - 1.3. Required properties of steel bars and its mechanical composite action with concrete
   - 1.4. Advantages and disadvantages of RCC structures
   - 1.5. Objective of RCC design
   - 1.6. Various Types of loads and stresses in RCC structures
   - 1.7. Introduction to different design philosophies and their comparison
   - 1.8. Importance of steel reinforcement in hydraulic structures

2. Limit state design method as probabilistic method (3 hours)
   - 2.1 Limit state of collapse and serviceability
   - 2.2 Determination of characteristic strength and characteristic load
   - 2.3 Partial safety factors for material strengths and loads
   - 2.4 Determination method of design strength of concrete and steel
   - 2.5 Codal provisions for different strengths
   - 2.6 Deflection control criteria

3. Design of Beam and Slabs (10 hours)
   - 3.1 Flexural analysis of rectangular section under bending
   - 3.2 Flexural mode of failure: Balanced, Under and Over reinforced sections
   - 3.3 Shear design
   - 3.4 Torsion design
   - 3.5 Minimum required and provided development length
   - 3.6 Codal provisions for design
   - 3.7 Detail design of singly reinforced rectangular beam
   - 3.8 Section analysis of doubly reinforced beam
   - 3.9 Detail design of doubly reinforced section
   - 3.10 Analysis and detail design of flanged beam
   - 3.11 Detail design of continuous beam
   - 3.12 Detail design of one way slab
   - 3.13 Detail design of two way slab
   - 3.14 Design of spillway slab
   - 3.15 Design criteria of culvert slab

4. Design of Columns
   - 4.1 Detail design of pure axially loaded column (8 hours)
   - 4.2 Detail design of axial load with uniaxial bending column
   - 4.3 Detail design of axially loaded with bi-axial bending column
   - 4.4 Detail design of braced slender column with single curvature
   - 4.5 Detail design of braced slender column with double curvature
   - 4.6 Detail design of un-braced slender column
   - 4.7 Design of anchor blocks
   - 4.8 Design of sheet pile and shear wall
   - 4.9 Design of retaining wall

5. Design of Footings and Staircases (6 hours)
   - 5.1 Detail design of isolated footing (with and without bending)
   - 5.2 Detail design of combined footing
   - 5.3 Detail design of raft (mat) footing
   - 5.4 Design concept of pile foundation
   - 5.5 Design of machine foundation
   - 5.6 Detail design of staircases

6. Design of Pre-stressed Concrete (6 hours)
   - 6.1 Materials for Pre-stressed Concrete
   - 6.2 Types and systems of pre-stressing

6.3 Pre-stress Loss
6.4 Analysis and design of homogeneous beam under flexure
6.4.1 Load balancing Approach
6.4.2 Flexural Approach
6.4.3 Thrust Approach (Pressure line approach)
6.5 Design of pre-stressed concrete poles
6.6 Deflection of pre-stressed concrete members

7. Introduction and design criteria of dam (2 hours.)
7.1 Introduction of concrete dam
7.2 design criteria of concrete dam

8. Earthquake resistant analysis and design (4 hours.)
8.1 Introduction (earthquake records, plate tectonics, seismic waves, faults)
8.2 Philosophy of design of structures in earthquake prone region
8.3 Introduction to earthquake resisting performance expectations including dashpot system
8.4 Ductility requirement for beam, column and joints
8.5 Introduction to liquefaction
8.6 The importance and implications of structural regularity

References

1. Ashok K. Jain, Reinforced Concrete Limit State Design. 7th Edition, 2012.
2. S Unnikrishna Pillai & Devdas Menon, Reinforced Concrete Design, 3rd Edition, 2009.
3. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumae Jain, Limit State Design of Reinforced Concrete (As per IS 456-2000), Reprint-2014. 6. S N Sinha, Reinforced Concrete Design, 3rd Edition, Second Print-2015.
4. Neelam Sharma, Reinforced Cement Concrete Design, 1st Edition, 2014.
5. Sujeet Kumar, Design of Concrete Structures-I, 1st Edition, 2014.

Evaluation scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	4	5
2	3	4
3	10	10
4	8	8
5	6	8
6	6	8
7	2	3
8	6	4
Total	**45**	**50**

***** There may be minor variation in marks distribution

CONSTRUCTION PROJECT MANAGEMENT

COURSE CODE: MS471

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	-	50		50		100	

Course Objectives: The objective of the course is to provide students the knowledge on the management and execution of the construction and maintenance works.

1. Introduction (2 hours)
   - 1.1. Scope and necessity of construction management
   - 1.2. Construction project characteristics
   - 1.3. Construction project management
   - 1.4. Construction execution methods

2. Specifications (5 hours)
   - 2.1. Purpose of specifications
   - 2.2. Types of specifications: general and detailed specifications
   - 2.3. Specification writing - techniques, use of international and local standards, code of practice
   - 2.4. Importance of specifications

3. Contractual Procedure (7 hours)
   - 3.1. Method of execution of work
   - 3.2. Types of contract
   - 3.3. Tender and tender notice
   - 3.4. Tender guarantee
   - 3.5. Preparation before inviting tender
   - 3.6. Contractor's pre-qualification
   - 3.7. Evaluation of tenders and selection of contractor
   - 3.8. Contract acceptance and Conditions of contract
   - 3.9. Responsibility of site engineer
   - 3.10. Supervising work of a contractor
   - 3.11. Site order book
   - 3.12. Procedure to prepare bills
   - 3.13. Measurement book and muster roll
   - 3.14. Relation between owner, contractor and consultants

4. Construction Equipment (8 hours)
   - 4.1. Advantages and disadvantages of using equipments
   - 4.2. Equipment for excavation, fill, transportation and compaction
   - 4.3. Aggregate handling and concrete construction equipment
   - 4.4. Equipment for construction of pipes and cassions
   - 4.5. Cranes for lifting materials and parts
   - 4.6. Equipment for tunnel construction and hydraulic construction
   - 4.7. Equipment for highway and pavement construction and Selection of appropriate equipment

5. Construction Planning (6 hours)
   - 5.1. Site surveying and preparation
   - 5.2. Arrangement of facilities and job layouts
   - 5.3. Selection of personnel
   - 5.4. Selection of construction plant and equipment
   - 5.5. Material handling system
   - 5.6. Construction scheduling: network techniques and barcharts
   - 5.7. Use of C.P.M. and PERT for planning, scheduling and controlling of construction works
   - 5.8. Procurement procedure for materials
   - 5.9. Finance management
   - 5.10. Cash flows and financial accounting
   - 5.11. Cost analysis and control
   - 5.12. Time-cost trade off

6. Regulatory Requirements (3 hours)
   - 6.1. Safety regulations, Fire regulations and Insurance
   - 6.2. Workman's compensation board
   - 6.3. Environment concerns and protection of the environment
   - 6.4. Building codes and quality control

7. Construction Safety Management (3 hours)
   - 7.1. Modern safety concept
   - 7.2. Accidents/ causes of accidents

7.3. Prevention of accidents
7.4. Managing safety
7.5. Contract condition on safety
7.6. Cost of safety economy

8. Project Maintenance (4 hours)
   8.1. Importance of maintenance
   8.2. Maintenance types: routine, minor, major, schedules, non-schedules and diagnostic
   8.3. Planning and scheduling of maintenance
   8.4. Estimating maintenance cost
   8.5. Management of maintenance and its financing

9. Personnel Management (5 hours)
   9.1. Management principles: administration and organization principles
   9.2. Centralization and decentralization
   9.3. Supervisory and leadership styles
   9.4. Importance of communication
   9.5. Information systems for decisions
   9.6. Motivating and directing: human elements, evaluation and merit rating
   9.7. Personnel selection, testing and training
   9.8. Trade unions and relation with management

10. Record Keeping and Reporting (5 hours)
   10.1. Importance of record keeping for construction and maintenance
   10.2. Control of changes during construction or maintenance
   10.3. Importance of receipts in calculating taxes
   10.4. Accounting statements: balance sheets, profit and losses
   10.5. Lost data for materials, labor, overheads and other expenses
   10.6. Cost ascertainment - cost unit, activity costing and other cost characteristics
   10.7. Cost comparisons and checking

Reference books:

1. B.L. Gupta, and A. Gupta, "Construction Management and Machinery", Standard Publisher Distributors, New Delhi.
2. G.S. Birdie, "Estimating Valuation and Specification", Dhanpat Rai & Sons, India.
3. K.K. Chitkara, "Construction Project Management", McGraw Hill, New York.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	2	2
2	5	5
3	7	6
4	8	8
5	6	6
6	3	4
7	3	4
8	4	5
9	5	5
10	5	5
Total	**48**	**50**

* There may be minor variation in marks distribution

ESTIMATING AND VALUATION

COURSE CODE: HE473

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objectives: The basic objective of the course is to provide the students basic knowledge of estimating, costing and valuation of building and hydropower engineering works. After completing this course the students will be able to analyze the rates of various civil construction activities.

1. Introduction and Method of Estimating (6 hours)
   - 1.1. Purpose of estimating
   - 1.2. System of units
   - 1.3. Units of measurement and payments for items of work and materials
   - 1.4. Requirement of estimating
   - 1.5. Method of estimating
   - 1.6. Methods of measurements of building and hydropower engineering works
   - 1.7. Subheads of various items of work
   - 1.8. Various methods of taking out quantities: centre line method, long and short wall method, crossing method
   - 1.9. Abstracting bills of quantities
   - 1.10. Preparation of detail estimation: Cost of items, contingencies work, charged establishment

2. Types of Estimate (3 hours)
   - 2.1. Approximate estimates
   - 2.2. Detailed estimates
   - 2.3. Revised estimates
   - 2.4. Supplementary estimates
   - 2.5. Annual repair or annual maintenance estimates
   - 2.6. Extension and improvement estimates
   - 2.7. Complete estimates
   - 2.8. Split up of cost of building works

3. Analysis of Rates (10 hours)
   - 3.1. Introduction
   - 3.2. Purposes of rate analysis
   - 3.3. Importance of rate analysis
   - 3.4. Requirements of rate analysis
   - 3.5. Factors affecting the rate analysis
   - 3.6. Procedure of rate analysis: for building works, for sanitary and water supply works, for road work, for irrigation works, for suspension bridge works

4. Detailed Estimate (20 hours)
   - 4.1. Estimate for a single room building
   - 4.2. Estimate for a two room building
   - 4.3. Estimate of earth work in road construction in plain and hilly area
   - 4.4. Estimate of earth work in canal
   - 4.5. Estimate for construction of highways for 500 m length
   - 4.6. Estimate of an aqueduct
   - 4.7. Estimate of R.C.C. slab culvert
   - 4.8. Estimate of R.C.C. T-Beam decking
   - 4.9. Estimate of septic tank and soak pit
   - 4.10. Estimate of underground R.C.C water tank
   - 4.11. Estimate of well foundation
   - 4.12. Estimate of a residential toilet

5. Valuation (6 hours)
   - 5.1. Introduction
   - 5.2. Purpose of valuation
   - 5.3. Principles of valuation
   - 5.4. Terms used in valuation
   - 5.5. Methods of determining value of property
   - 5.6. Methods of valuation report writing

Tutorial:

1. Estimate for a single room building (Load bearing wall and frame structure)
2. Estimate for a double storey residential building (Load bearing wall and frame structure)
3. Estimate of earth work in road construction in plain and hilly area
4. Estimate of earth work in canal
5. Estimate for construction of highways for 500 m length
6. Estimate of an aqueduct
7. Estimate of R.C.C. slab culvert
8. Estimate of R.C.C. T-Beam decking
9. Estimate of septic tank and soak pit
10. Estimate of underground R.C.C water tank
11. Estimate of a residential toilet
12. A valuation report of a property

Reference books:

1. A. Aggrawal, “Civil Estimating Quantity Surveying and Valuation", Katson Publishing House, Ludhiana.
2. B.N Dutta, “Estimating and Costing”, S. Dutta and Company, Lucknow.
3. M. Chakraborti, “Estimating, Costing, Specification and Valuation”, M. Chakraborti, India.
4. S. Berger, and J.B. Godel, "Estimating and Project Management for Small Construction Firms", Van Nostradn Reinhold Publishing Company, New York.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks Distribution
1	6	6
2	3	4
3	10	12
4	20	20
5	6	8
Total	**45**	**50**

* There may be minor variation in marks distribution

ENGINEERING ETHICS AND ENTREPRENEURSHIP

Course code: HE474

Year: IV
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total	Remarks
			Final		Internal Assessments		Marks	
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	-	50	-	50	-	100	

Course Objective: This course has following objectives:

i. To understand the moral values that ought to guide the Engineering profession,
ii. To resolve the moral issues in the profession, and
iii. To justify the moral judgment concerning the profession.

Contents

1. Background and perspectives (3 hours)
   1.1. Introduction to society, elements of society,
   1.2. Factors causing social change,
   1.3. Theories of social change Technology
   1.4. Technological change and influence of technological change on society,
   1.5. Characteristics of developing and developed countries and technological achievement of the 20th century
2. Ethics and professional practice (8 hours)
   2.1. Ethics, moral and non-moral actions
   2.2. Profession, features of profession, professional engineering
   2.3. Code of ethics and guidelines for professional engineering practice
   2.4. Role of professional associations
   2.5. Professional engineering, definition of engineer,
   2.6. Nepal engineering council, Nepal engineers association
   2.7. Surveyors' association
3. Role of international communities and their activities: (4 hours)
   3.1. International organization of geodesy (FIG)
   3.2. International society of photogrammetric and remote sensing (ISPRS)
   3.3. Asian association of remote sensing
   3.4. Permanent committee on GIS infrastructure for Asia and the Pacific (PCGIAP)
   3.5. International steering committee for global mapping (ISCGM), International organization for standard (ISO)
4. Issues in Engineering (3 hours)
   4.1. Globalization and cross cultural issues
   4.2. Public private partnership
   4.3. Safety, risk and benefit analysis
   4.4. Conflict and dispute management
5. Case studies and a small study in a group of 4 members (7 hours)
   5.1. Adaptation in Changing environment:
   5.2. Meaning of adaptation, social conflicts, social stratification,
   5.3. Stories of project failure and foreign aid cancellation in the context of Nepal (e.g. Arun third), project delay , causes and effects of project delay, examples of Kaligandaki and Madhya Marsyangdi projects.
6. Entrepreneurship (4 hours)

6.1. Meaning of entrepreneurship,

6.2. Survey for new schemes, needof skill development training and creation of new jobs in the society, Participatory approach for project planning, use of planning tools like PRA, RRA and AI, concept writing and proposal writing for implementation of new technology and for providing jobs. Develop a concept among the engineering students like engineers are the job provider not the job seekers.

7. Group discussion among this topic within the classes dividing the classes into many groups. (1 hour)

Reference books:

1. C. Morrison, and P.Hughes, "Professional Engineering Practice-Ethical Aspects", McGraw-Hill Ryerson Ltd., Toranto.
2. R. Adhikari, "Engineering Professional Practice- Nepalese and International Prospectives", Pashupati Publishing House, Kathmandu.
3. Nepal Engineering Council Act
4. Contract Act
5. Labor Act
6. Company Act
7. Public Procurement Act
8. Building By-Laws

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks Distribution
1	2	5
2	6	10
3	4	8
4	4	6
5	3	4
6	7	12
7	4	9
Total	**30**	**50**

* There may be minor variation in marks distribution

ELECTIVE II AND ELECTIVE III

COURSE CODE: HE47*

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	-	50	-	50	-	100	

Selection of Electives II and Elective III:

The main purpose of elective courses is to equip undergraduate students with specialized knowledge and skill on anyone of the three main streams of hydropower engineering:

1. Modelling of Water Resources
2. Water Supply and Sanitation
3. Building Technology

The course other than above listed can accept by the subject committee and course detail will be presented to the students before the commencement of the course.

MODELING OF WATER RESOURCES

COURSE CODE: HE475

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	0	50	25	125	

Course Objectives: To provide knowledge of numerical simulations in water resources engineering problems related to watershed management and their implementation by conducting watershed modeling using various software like HEC-HMS, HEC-RAS, FESWMS etc. Students will learn to develop the model setup, simulation of model and post-processing of results. Computational Techniques in Water Resources Engineering is the prerequisite course for this course.

1. Introduction (3 hours)
   - 1.1 Water as a limited resource and its impacts
   - 1.2 Dublin principles
   - 1.3 Integrated water resources management and its principles
   - 1.4 System and its elements
   - 1.5 Physical modeling and numerical modeling

2. Watershed modeling (5 hours)
   - 2.1 Watershed
   - 2.2 Direct methods to measure runoff
   - 2.3 Watershed modeling and its importance
   - 2.4 Uses of watershed models
   - 2.5 Modeling software
   - 2.6 Modeling approaches
     - 2.6.1 Spatial scale – lumped, semi distributed and fully distributed
     - 2.6.2 Temporal scale
       - 2.6.2.1 Event based calculation and continuous simulation
       - 2.6.2.2 Empirical approach and physically based approach
   - 2.7 Scale issues in watershed modeling process – spatial scale and temporal scale

3. Hydrologic modeling (12 hours)
   - 3.1 Steps to hydrologic modeling
   - 3.2 Input and output of hydrologic modeling
   - 3.3 Introduction to HEC-HMS
     - 3.3.1 Application of HEC-HMS
     - 3.3.2 Advantages and disadvantages
     - 3.3.3 HEC-HMS model development and preparation
   - 3.4 Indirect methods to estimate runoff
     - 3.4.1 Rational method
     - 3.4.2 NRCS-CN method
     - 3.4.3 Hydest method
     - 3.4.4 CIA method

4. Hydraulic modeling (8 hours)
   - 4.1 Steps to hydraulic modeling
   - 4.2 Input/output of hydraulic modeling
   - 4.3 Introduction to HEC-RAS
     - 4.3.1 Application of HEC-RAS
     - 4.3.2 Advantages and disadvantages
     - 4.3.3 HEC-RAS model development and preparation
   - 4.4 Introduction to Delft-3D and its application
     - 4.4.1 River flow simulation using Delft-3D

4.4.2 Geometry creation, model set up and simulation
4.5 Large Eddy Simulation

5. Watershed modeling - planning and implementation (7 hours)
   5.1 Advantages of large scale models
   5.2 Sub-watershed prioritization
   5.3 Model simulation, calibration and validation
   5.4 Research issues in watershed management
   5.5 Watershed management activities and application of watershed modeling

6. Hydraulic modeling to control erosion – use of software (10 hours)
   6.1 Bank erosion controlling measures
   6.2 Introduction to Ansys Fluent
      6.2.1 Use and application of Fluent
      6.2.2 Domain preparation in Fluent
      6.2.3 Discretiztion of domain
      6.2.4 Application of boundary and initial conditions
      6.2.5 Simulation and validation
   6.3 FESWMS and its application
      6.3.1 Geometry preparation
      6.3.2 Model setup and simulation
      6.3.3 Analysis of results and selection of best design

Case studies/Practical:

1. Analysis of a local river using HEC-RAS (it requires bathymetry survey and discharge measurement)
2. Design of barbs for a local river using FESWMS or Fluent
3. Use of HEC-HMS or SWAT for a local catchment

Students will work on group for case studies. There will be group presentation for the investigations on the cases. A final report of the case studies shall be submitted to the course instructor.

Reference Books:

1. P. Y. Julien, “River Mechanics”, Cambridge University Press.
2. S. C. Jain, “Open – Channel Flow”, John Wiley & Sons, Inc.
3. W. H. Press, S. A. Teukolsky, W. T. Vetterling, B. P. Flannery, “Numerical Recipes in C, The Art of Scientific Computing”, Cambridge University Press.
4. W. Rodi, G. Constantinescu, T. Stoesser, “Large Eddy Simulation in Hydraulics”, CRC Press.
5. J. H. Ferziger, M. Peric, “Computational Methods for Fluid Dynamics”, Springer.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	3	4
2	5	6
3	12	15
4	8	8
5	7	7
6	10	10
Total	45	50

* There may be minor deviation in marks distribution.

WATER SUPPLY AND SANITATION ENGINEERING

COURSE CODE: HE476

Year: IV

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objectives: The basic objective of the course is to provide a sound knowledge and skills with regards to design and development of engineering system, structure and methods relating to water supply and sanitation. The contents covered include quantity and quality consideration in water supply system, water treatment technology, and design consideration of gravity flow system, quantity and quality of sewage, sewage treatment and waste management.

1. Introduction **(2 hours)**

1.1. Water supply, its objectives, immediate and long term impact
1.2. Definition: Pure, impure water, potable, wholesome water, polluted, contaminated water
1.3. Water supply scheme with their major components: Rural and Urban

2. Sources, **(2 hours)**

2.1. Classification of sources of water
2.1.1. Surface water sources: Rivers, streams, lakes, ponds, and impounded reservoir
2.1.2. Under Ground/Ground sources: springs, wells, infiltration galleries
2.2. Choice of sources

3. Quantity and Quality of Water **(6 hours)**

3.1. Types of demand: Domestic, livestock, commercial, public/municipal, industrial, firefighting, loss and wastage
3.2. Population forecast
3.3. Computation of quantity of water
3.4. Fluctuation in demand
3.5. Factor affecting demand
3.6. Impurities in water: suspended, colloidal and dissolved impurities
3.7. Hardness of water, types of hardness, and alkalinity in water
3.8. Water borne diseases and their control
3.9. Collection of water sample
3.10. Physical, chemical and biological tests
3.11. Water quality standard, WHO standard and Nepal standard for domestic use

4. Intakes **(2 hours)**

4.1. Site selection for intake
4.2. Characteristics of intake: River intakes, reservoir intake, and spring intake

5. Water Treatment **(8 hours)**

5.1. Objectives of water treatment
5.2. Layout of water treatment plant
5.3. Basic principles of working of treatment plants
5.4. Various stages of treatment of influent water
5.4.1. Screening: Coarse and Fines
5.4.2. Function of coagulation in treatment plant
5.4.3. Sedimentation: theory, types of sedimentation tanks, design considerations of sedimentation tank;
5.4.4. Filtration
5.4.5. Disinfection
5.4.6. Water softening

6. Reservoirs and Distribution System **(4 hours)**

6.1. Types of reservoir
6.2. Determination of capacity of reservoir:

6.3. System of water distribution and layout
6.4. Design of distribution system

7. Conveyance of Water (2 hours)
7.1. Types of pipes used for conveyance
7.2. Pipe joints
7.3. Types of valves
7.4. Pipe fittings and fixtures

8. Gravity Flow Water Supply System (2 hours)
8.1. Feasibility and detailed surveying;
8.2. Break Pressure Tanks; Public stand post; River and stream crossings;
8.3. Maintenance of Water Supply System

9. Sanitation system (2 hours)
9.1. Objective of sewage disposal
9.2. Sanitation system: Conservancy system and water carriage system
9.3. Types of sewerage system: combined, separate and partially separate systems

10. Quantity of Wastewater (3 hours)
10.1. Sources of sanitary sewage
10.2. Dry weather flow and wet weather flow
10.3. Determination of quantity of sanitary sewage
10.4. Determination of quantity of storm water (Tangent and rational method and its limitation)

11. Characteristic of Sewage (4 hours)
11.1. Constituent of sewage
11.2. Different characteristics of sewage: Physical, Chemical and Biological
11.3. Decomposition of sewage: Aerobic and anaerobic
11.4. Biochemical oxygen demand (BOD) and Chemical oxygen demand (COD)

12. Design and Construction of Sewer (4 hour)
12.1. Shape of sewers: Circular and Non-circular
12.2. Sewer materials: requirements, salt glazed stoneware, C.I and cement concrete pipes
12.3. Typical design periods, flow velocity, flow diagrams, hydraulic formulae and gradients
12.4. Design of the sewer for separate and combined systems
12.5. Construction of sewer: excavation, laying, joining of sewer testing of sewer: water test.

13. Sewer Appurtenances(2 hour)
13.1. Necessity of sewer appurtenances
13.2. Construction of sewer appurtenances
13.2.1.Manhole, Drop manhole, Lamp hole
13.2.2.Street inlets, Catch basin, Flushing device, Sand, grease and oil traps, Inverted siphon, Sewer outlet, Ventilating shaft

14. Sewage Disposal (4 hour)

14.1. Objective of sewage disposal
14.2. Methods of Sewage Disposal: Dilution and Land Treatment
13.2.1 Dilution Process: Essential condition for dilution,
13.2.2 Self-purification of streams, factors affecting self-purification, Oxygen sag curve, Streeter-Phelps equation
14.3. Disposal of sewage by Land treatment:
14.3.1.Suitability of land treatment, methods of and treatment irrigation, over land flow and rapid filtration

15. Sewage Treatment (5hours)
15.1. Objective of treatment and different treatment methods: physical, chemical, biological
15.2. Preliminary treatment processes: Bar racks, skimming tanks, grit chamber,
15.3. Primary Treatment Process: Sedimentation, and chemical precipitation
15.4. Secondary treatment processes and their types:
15.4.1.Principles of biological treatment:
15.4.2.Attached growth process: Intermittent sand filler, Contact bed filters, and Concept of Trickling
15.4.3.Suspended growth process: Concept of Activates sludge process and Oxidation ponds:

16. Sludge Treatment and Disposal (3 hours)

16.1. Sources of sludge and necessity of sludge treatment
16.2. Characteristics of sludge
16.3. Sludge thickening and concentration
16.4. Sludge treatment methods: Grinding and blending, thickening, digestion, dewatering, drying, composting/incineration/ final disposal
16.5. Methods of sludge disposal: spreading on land, lagooning, dumping, and land filling

17. Disposal of Sewage from Construction Sites (Isolated Buildings) (3 hours)

17.1. Privies: Pit privy, ventilated improved pit (VIP) latrine and pour flush latrine
17.2. Septic tank; Purpose, construction, design criteria, working and maintenance
17.3. Disposal of septic tank effluent: Drain field, soak pit,

18. Solid waste management in Construction Sites (2 hours)

18.1. Types solid waste;
18.2. Collection and separation;
18.3. Disposal of solid waste- dumping, sanitary land filling, composting, incineration.

Laboratory/Practical:

1. Determination of temperature, color, turbidity and pH
2. Determination of suspended, dissolved and total solids
3. Determination dissolved oxygen by Winkler method
4. Determination of optimum dose of coagulant by jar test apparatus
5. Determination of BOD of Sewage sample by Winkler Mehods.
6. Case Study: Overview and case study of Water Supply and Sanitation practices in Construction sites (Hydropower Project Sites) and design the proper water supply system & waste (solid/ sewage) management.

Reference books:

1. G.S. Birdie, and J.S. Birdie, "Water Supply and Sanitary Engineering", Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. B.S.N. Raju, “Water Supply and Wastewater Engineering”, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. K.N. Duggal, "Elements of Environmental Engineering", S. Chand and company Ltd.., New Delhi.
4. B.C. Punmia, A. K. Jain, and A. Jain, "Water Supply Engineering", Laxmi Publications (P) Ltd., New Delhi.
5. P.N. Modi, "Sewage Treatment & Disposal and Wastewater Engineering", Standard Book House, Delhi.
6. Text book of “water supply & Sanitary Engg.” S.K.Hussain Oxford & IBH
7. Vazirani&Chandola ,“Water supply & Sanitary Engg”., Khanna Publishers Allied Book Stall,

BUILDING TECHNOLOGY

COURSE CODE: HE477

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50		50		100	

Course Objectives: This course is designed to provide knowledge in building construction techniques and technology. It also aims to provide knowledge and skills on preparing final municipal drawings.

1. Introduction to Building and Planning (8 hours)
   - 1.1. Building and its classification based on occupancy, storey and height
   - 1.2. Components of Buildings and their functions
   - 1.3. Design Loads
   - 1.4. Orientation and Principles of Planning of Building
   - 1.5. General Rules of Vaastu
   - 1.6. Introduction to Building Byelaws and Building Codes and their enforcement
   - 1.7. Architectural Design Criteria of Building as per NBC
   - 1.8. FAR, GCR calculations
   - 1.9. Open Space Requirements and its importance

2. Foundations and Excavation Works (7 hours)
   - 2.1. Foundation and its types
   - 2.2. Factors that determine the choice of foundation
   - 2.3. Bearing capacity of soil and methods of determination
   - 2.4. Safe bearing capacity values based on NS and IS codes
   - 2.5. Methods of improving bearing capacity of soil
   - 2.6. Methods of Excavation, Tools, equipment and plants used for excavation
   - 2.7. Solutions to excavations problems (Earthwork support, timbering battering and dewatering)

3. Mortars & Masonry works (4 hours)
   - 3.1. Mortars (types, properties, preparation process, estimating mortar requirement)
   - 3.2. Brick masonry (types, specifications)
   - 3.3. Stone masonry (random rubble, course rubble, ashlar)
   - 3.4. Reinforced brickwork
   - 3.5. Walls: Retaining walls, partition walls, cavity walls, parapet walls

4. Stair and Roofs (5 hours)
   - 4.1. Stair and its elements
   - 4.2. Essential requirements & types of stair
   - 4.3. Design of stairs (dog-legged and open well)
   - 4.4. Ladders, ramps, lifts & escalators
   - 4.5. Roofs and its classification
   - 4.6. Roof coverings

5. Openings (3 hours)
   - 5.1. Doors: Types and their fixing details
   - 5.2. Windows & ventilators: Types and their fixing details
   - 5.3. Merits and Demerits of Metal doors and windows.

5.4. Arch and Lintels

6. Flooring (2 hours)
   6.1. Flooring and its types
   6.2. Special types of floor finishing (smooth cast, rough cast, pebble dash, scrapped finish, and texture finish)
   6.3. Floor and wall ties

7. Temporary Construction (5 hours)
   7.1. Scaffolding and its types
   7.2. Formwork for excavations & trenches
   7.3. Formworks for RCC construction
   7.4. Shoring and its types
   7.5. Underpinning and its procedures

8. Finishing Works (2 hours)
   8.1. Cladding (types, fixing process)
   8.2. Plastering & pointing (types and process of application)
   8.3. Painting works in wooden, metal and masonry surfaces
   8.4. Internal finishing: Non-load bearing partitions and suspended ceiling

9. Earthquake Protection, Retrofitting and Maintenance of Building (5 hours)
   9.1. Provisions for Earthquake Protection of Building
   9.2. Retrofitting techniques
   9.3. Causes of Dampness and Water Proofing
   9.4. Materials used in Damp proofing
   9.5. Damp proofing treatment in building components (Foundation, walls, roofs and parapet walls
   9.6. Causes of cracks and Repair
   9.7. Settlement of Foundation: Types, causes and remedial measures
   9.8. Maintenance of Building; Daily maintenance, special treatments

10. Other Services in Building (2 hours)
    10.1. Water supply & sanitation
    10.2. Electrification, CCTV and telephone network
    10.3. Fire protection
    10.4. Rainwater harvesting

11. Green Buildings as a solution to Sustainable Future (3 hours)
    11.1. Green Building Concept and Benefits
    11.2. Materials used in Green Construction
    11.3. Making a building green
    11.4. Model of Green House

Practical:

1. Design residential/office building (at least two story's) with three or more rooms as per existing building code and nearby municipality Building Bye-laws and prepare complete working drawings with essential details using Autocad
2. Prepare a model of Green Home

Tutorial:

1. Classify minimum three buildings nearby your institute with reference to NBC code and prepare a report
2. Calculate FAR, GCR
3. Design of Staircase

Field Trip:

The student shall visit the construction site under supervision of faculty member /Site In-charge and prepare a brief report containing sketches and photographs of site visits.

Reference books:

1. B.C. Punmia, “Building Construction”, Laxmi Publications (P) Ltd., India.
2. K.S. Jagadish, B.V.V. Reddy, and K.S.N. Rao, “Alternative Building Materials and Technologies”, New Age International Publishers, New Delhi.
3. S.K. Duggal, “Building Materials”, New Age International Publishers, New Delhi.
4. Rangwala"Building Construcion"
5. S.P. Arora, and S.P. Bindra, “Building Construction”, Dhanpat Rai and Sons, India.
6. S. Kumar, “Building Construction”, Standard Publishers Distributors, New Delhi.
7. D. Dernie, “Architectural Drawing”, Laurence King Publishing Ltd., London.
8. F.D.K. Ching, “Architecture: Form, Space and Order”, VNR, New York.
9. E. D. Mills, “Planning and Architects Handbook”, Butterworth, London.
10. S. Tikko, “AutoCAD 2012: A Problem-Solving Approach”, Autodesk Press, USA
11. Francis D.K.Ching"Building Construction Illustrated" Wiley
12. Varis Bokalders and Maria Block "The Whole Building Handbook"
13. Building Bye-laws
14. http://dudbc.gov.np/buildingcode
15. https://www.greenbuildingsolutions.org/
16. http://unhabitat.org.np/greenhomes/

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution*
1	7	8
2	7	7
3	4	4
4	5	6
5	3	4
6	2	3
7	5	4
8	2	3
9	5	5
10-11	5	6
Total	**45**	**50**

B.E. (HYDROPOWER) FOURTH YEAR DETAIL SYLLABUS

(SECOND SEMESTER)

HYDROPOWER ENGINEERING PROJECT II

COURSE CODE: HE481

Year: IV
Semester: I

Teaching Schedule Hours/ Week				Examination Scheme			Total Marks	Remarks
				Final	Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
1	6	-	-	50	-	50	100	

Course Objective: Hydropower Engineering Project II is the continuation of Hydropower Engineering Project I. In Project II, students are required to complete following works in carry-over of the Project I falling under different categories of project works:

1. Design type project
    1.1. Design of the System and their Alternatives
    1.2. Detail Drawings
    1.3. Cost Estimation
    1.4. Economic and Financial Analysis
    1.5. References
2. Dissertation type project
    2.1. Model Formation
    2.2. Model Application
    2.3. Results and Discussions
    2.4. Larger Implications
    2.5. Conclusion and Recommendations
    2.6. References
3. Experimental type project
    3.1. Formulation of Hypothesis
    3.2. Analysis of Results and Model Application
    3.3. Results and Discussions
    3.4. Larger Implications
    3.5. Conclusion and Recommendations
    3.6. References

At the initial phase, the faculty may conduct a number of lectures and discussions as to the approach of the project. In the later phase, the student will be left on his/their won to pursue his/their work and to consult the faculty whenever any problem crops up. The student should then compile both the works of Hydropower Engineering Project I and II and submit a draft report, prior to the final report, so that the supervisor can review the work, and correct the mistakes, if necessary. The final draft of the report of the report shall be submitted to the Head of Department in duplicate.

INTERNSHIP

COURSE CODE: HE482

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
-	-	-	-	50	-	50	100	

Course Objective: Internship is solely designed to provide students with the on-site working experience in various sectors of Hydropower Engineering. Each student is required to work a period of 3 months in an industry or an organization or in a research institute where he/she will have the opportunity to experience job training.

Before commencing the internship, the student should submit a formal proposal to the Head of Department of the Campus. Internship should be accepted and the organization in the student wants to pursue his/her internship should be approved by the Department Head.

Students are to work in the direction, management, and guidance of the organization of their choice. Student progress and quality of work is determined and reported by the organization. University faculty will make at-least one random on-site visit of the organization to determine the quality of work and the level of service offered by the student.

Duration of Internship: The duration of the internship shall in no case be less than 3 months.

Evaluation Process:

i. Internal Evaluation is based on the observation made during the organization visit, where the faculty conducts a thorough study of the daily log book, professional discipline, professional growth, etc. of the student
ii. The final evaluation is based on the observation made by the organization during the course of internship