TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

TU LOGO

CURRICULUM

BACHELOR'S DEGREE IN CIVIL ENGINEERING

First Revision
November 1999

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INTRODUCTION:

The Institute of Engineering, Pulchowk Campus, is offering this course with the objective of producing high level technical manpower capable of undertaking works in the Civil Engineering field. The details of the course are as follows.

1. Title of the Course:

   Bachelor of Engineering in 'Civil Engineering'.

2. Objective of the Course:

   To train students in technical and analytical skills required to enable them to function and practice as professional Civil Engineers on all aspects of Civil Engineering works.

3. Duration of the Course:

   The total duration of the course is 4 years. Each year consists of two parts. A and B, each part having a duration of 90 working days (about 15 weeks).

4. Entry Requirements:

   The minimum requirements for admission to the courses are:

   (a) The candidate must have passed Intermediate of Science (Physical Group) examination of the Tribhuvan University or 10+2 (Physical Group) or equivalent course recognized by the Tribhuvan University; and have scored at least 50% of the total marks in aggregate;

   or

   The candidate must have passed Diploma in Engineering of the Institute of Engineering Tribhuvan University or equivalent course with Physics, Chemistry, Mathematics and English as separate compulsory subjects, and have scored at least 50% of the total marks in aggregate:

   and

   (b) The candidate must pass the entrance admission tests conducted by the Institute of Engineering.

5. Selection:

   Students fulfilling the minimum eligible requirements will be selected for admission on the basis of merit.

6. Course Structure:

6.1 Contents:

The teaching of the course is divided into 8 parts (half yearly). The first two parts are of prerequisite nature.

6.2 Subject Codes:

Each subject is coded with a unique member preceded and followed by certain letters. The code for all subjects offered in engineering disciplines begin with two letters 'EG', followed by three digit numbers denoting the subject offered in the particular half yearly part. The first digit denotes the year i.e. 4,5,6 and 7 for first, second, third and fourth year respectively of Bachelor's level course. The second digit from 0 to 4 is used for the first part of the year and 5 to 9 for the second part of the year. The third digit is used to identify the subject. The last letters denote the department which offers the subject (e.g. SH - Science and Humanities, CE - Civil Engineering, EE - Electrical Engineering, EX - Electronics Engineering, ME - Mechanical Engineering and AR - Architecture).

Example: EG623CE is the code for subject "Soil Mechanics" which is offered in the third year part A by the Civil Engineering Department.

6.3 Instruction Methods:

The method of teaching is lecture augmented by tutorials and practical works. Tutorials are used to enlarge and develop the topic and concepts stated in the lecture. Practical classes in the form of laboratory works and drawing office practice are used to verify the concepts and to develop necessary technical and analytical skills.

Examination and Marking Schemes:

The students' achievement in each subject is evaluate by internal assessment during the course followed by a final examination at the end of each half yearly part. A weightage of 20% for the internal assessment and that of 80% for the half yearly examination are allocated for the theoretical component of a subject. The half yearly examination of all theory component are conducted through written tests. In case of practical components, the method of continuous assessment is adopted; in some cases, half yearly examinations are also conducted.

The students must obtain 40% in the internal assessment and 40% in the half yearly examination of each subject to pass in the subject. Student who have not obtained the prescribed pass marks in the internal assessment of a subject will not be allowed to sit in the half yearly examination of continue his/her studies in the third year. Similarly, a student must pass all the papers of the second year to continue his/her studies in the fourth year.

Students who have passed all the components of all subjects in all of the ten parts are considered to have successfully completed the course. The overall achievement of each student is measured by a final aggregate percentage which is obtained by providing a

weightage to each of half yearly aggregate percentages scored by the student as prescribed below.

First & Second Years : 20% each
Third and Fourth : 30% each

Depending upon the final aggregate percentage scored, a division is award as follows:

80% and above : Distinction
65% and above : First Division
50% and above : Second Division
40% and above : Pass

First Revision
November, 1999

B. E.
IN
CIVIL ENGINEERING

Year : I **Part : A**

Teaching Schedule						Examination Scheme							
						Theory			Practical				
S. No.	Course Code Subject Titles	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks	Total	Remarks
1	EG 401 SH Mathematics I	3	2	-	5	20	3	80				100	* Continuous
2	EG 403 SH Chemistry	3	1	2	6	20	3	80	10	3	15	125	Assessment
3	EG 404 SH Communication I (Eng.)	1	3	-	4	10	1.5	40				50	
4	EG 433 ME Engineering Drawing I	1	-	3	4				60	3	40	100	
5	EG 441 CE Applied Mechanics I (Statics)	3	1.5	-	4.5	20	3	80				100	
6	EG 463 CE Civil Engg. Materials	3	-	1.5	4.5	20	3	80	25			125	
	Total	**14**	**7.5**	**6.5**	**28**	**90**	**13.5**	**360**	**95**	**6**	**65**	**600**	

B. E.
IN
CIVIL ENGINEERING

Year : I **Part : B**

Teaching Schedule						Examination Scheme						Total	Remarks
						Theory			Practical				
S. No.	Course Code / Subject Titles	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks		
1	EG 405 SH Intro. to Com. & Progra.	2	-	3	5	10	1.5	40	50			100	* Continuous
2	EG 432 M Workshop Technology I	1	-	3	4	-			50			50	Assessment
3	EG 471 SH Mathematics II	3	2	-	5	20	3	80				100	
4	EG 472 SH Physics	4	1	2	7	20	3	80	20	3	30	150	
5	EG 474 SH Communication II (Eng.)	1	3	-	4	10	1.5	40				50	
6	EG 483 M Engineering Drawing II	1	-	3	4				60	3	40	100	
7	EG 491 CE Applied Mechanics II (Dynamics)	3	1.5	-	4.5	20	3	80				100	
Total		**15**	**7.5**	**11**	**33.5**	**80**	**12**	**320**	**180**	**6**	**70**	**650**	

B. E.
IN
CIVIL ENGINEERING

Year : II **Part : A**

Teaching Schedule						Examination Scheme						Total	Remarks
						Theory			Practical				
S. No.	Course Code Subject Titles	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks		
1	EG 501 SH Mathematics III	3	2	0	5	20	3	80				100	* Continuous
2	EG 509 EE Electric Circuits & Machines	2	1	1.5	4.50	20	3	80	25			125	Assessment
3	EG 522 CE Strength of Materials	3	1	1	5	20	3	80	25			125	
4	EG 523 CE Engineering Geology	4	0	2	6	20	3	80	25			125	
5	EG 524 CE Fluid Mechanics	3	2	1	6	20	3	80	25			125	
6	EG 525 CE Surveying I	3	1	3	7	20	3	80	25	3	25	150	
	Total	**18**	**7**	**8.5**	**33.50**	**120**	**18**	**480**	**125**	**3**	**25**	**750**	

B. E.
IN
CIVIL ENGINEERING

Year : II **Part : B**

Teaching Schedule						Examination Scheme						Total	Remarks
						Theory			Practical				
S. No.	Course Code / Subject Titles	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks	Total	Remarks
1	EG 562 CE Theory of Structures I	3	2	1	6	20	3	80	25			125	* Continuous
2	EG 564 CE Hydraulics	4	2	1	7	20	3	80	25			125	Assessment
3	EG 565 CE Surveying II	3	-	3	6	20	3	80	25	3	25	150	
4	EG 569 ME Fundamentals of Thermodyn. & Heat	3	1	1.5	5.5	20	3	80	25			125	
5	EG 571 SH Probability & Statistics	3	1	-	4	20	3	80				100	
6	EG 579 EX Electronics & Instrumentation	3	1	1.5	5.5	20	3	80	25			125	
	Total	**19**	**7**	**8**	**34**	**120**	**18**	**480**	**125**	**3**	**25**	**750**	

B. E.
IN
CIVIL ENGINEERING

Year : III **Part : A**

Teaching Schedule						Examination Scheme						Total	Remarks
						Theory			Practical				
S. No.	Course Code / Subject Titles	L	T	P	Total	Assessment Marks	Final Duration Hrs.	Final Marks	Assessment Marks *	Final Duration Hrs.	Final Marks		
1	EG 601 SH Numerical Methods	3	-	3	6	20	3	80	50			150	* Continuous
2	EG 622 CE Theory of Structures II	4	2	1	7	20	3	80	25			125	Assessment
3	EG 623 CE Soil Mechanics	4	-	2	6	20	3	80	50			150	
4	EG 625 CE Survey Camp				2 wks.				50	viva	50	100	
5	EG 626 CE Building Technology	3	1	-	4	20	3	80				100	
6	EG 628 CE Water Supply Engineering	3	1	1	5	20	3	80	25			125	
7	EG 633 CE Concrete Technology	2	-	1.5	3.5	10	1.5	40	25			75	
	Total	**19**	**4**	**8.5**	**31.5**	**110**	**16.5**	**440**	**225**	**0**	**50**	**825**	

B. E.
IN
CIVIL ENGINEERING

Year : III **Part : B**

Teaching Schedule						Examination Scheme						Total	Remarks
						Theory			Practical				
S. N.	Course Code Subject Titles	L	T	P	Total	Assess-ment Marks	Final		Assess-ment Marks *	Final			
							Duration Hrs.	Marks		Duration Hrs.	Marks		
1	EG 662 CE Design of Timber & Steel Structures	4	2	-	6	20	3	80				100	* Continuous
2	EG 663 CE Foundation Engineering	4	-	2	6	20	3	80	50			150	Assessment
3	EG 664 CE Engineering Hydrology	3	1	1	5	20	3	80	25			125	
4	EG 666 CE Engineering Economics	3	1	-	4	20	3	80				100	
5	EG 668 CE Sanitary Engineering	3	1	-	4	20	3	80				100	
6	EG 673 CE Transportation Engineering I	4	1	1	6	20	3	80	25			125	
Total =		**21**	**6**	**4**	**31**	**120**	**18**	**480**	**100**	**-**	**-**	**700**	

B. E.
IN
CIVIL ENGINEERING

Year : IV **Part : A**

Teaching Schedule						Examination Scheme						Total	Remarks
						Theory			Practical				
S. No.	Course Code Subject Titles	L	T	P	Total	Assess-ment Marks	Final Duration Hrs.	Final Marks	Assess-ment Marks *	Final Duration Hrs.	Final Marks		
1	EG 706 CE Project Engineering	3	1	-	4	20	3	80				100	* Continuous
2	EG 722 CE Design of Reinforced Concrete Structures	4	1.5	1.5	7	20	3	80	25			125	Assessment
3	EG 723 CE Transportation Engineering II	4	1	1	6	20	3	80	25			125	
4	EG 724 CE Irrigation Engineering	3	2	-	5	20	3	80				100	
5	EG 726 CE Estimating & Valuation	3	3	-	6	20	3	80				100	
6	EG 73.. CE Elective I*	3	2	1	6	20	3	80				100	
	Total	**20**	**10.5**	**3.5**	**34**	**120**	**18**	**480**	**50**	**-**	**-**	**650**	

* EG735 - 739CE

B. E.
IN
CIVIL ENGINEERING

Year : IV **Part : B**

Teaching Schedule						Examination Scheme						Total	Remarks
						Theory			Practical				
S. No.	Course Code / Subject Titles	L	T	P	Total	Assessment Marks	Final Duration Hrs.	Final Marks	Assessment Marks *	Final Duration Hrs.	Final Marks		
1	EG 764 CE Hydropower Engineering	3	2	1	6	20	3	80	25			125	* Continuous
2	EG 766 CE Engineering Professional Practice	2	-	-	2	10	1.5	40				50	Assessment
3	EG 767 CE Technology Environment & Society	2	2	-	4	10	1.5	40				50	
4	EG 776 CE Management of Const. & Mainten.	3	2	-	5	20	3	80				100	
5	EG 777 CE Civil Engineering Project	-	-	9	9				150	viva	50	200	
6	EG 78.. CE Elective II*	3	2	1	6	20	3	80				100	
	Total	**13**	**8**	**11**	**32**	**80**	**12**	**320**	**175**	**-**	**50**	**625**	

* EG785 - 789CE

COMMON COURSES

MATHEMATICS I
EG401SH

Lecture: 3 Year: I
Tutorial: 2 Part: A

COURSE OBJECTIVES: It is assumed that incoming students have a good grounding in algebra, some knowledge of trigonometry and analytic geometry and previous to calculus. By the end of the course, students will have seen the development of all of the elementary functions, ranging from polynomials to the inverse hyperbolic functions. In parallel, the calculus will be developed, making use of the increasing richness of the available functions. The student's skills in differentiation and integration will thus be progressively improved. Simple applications of the calculus will be explored from time to time. The course will conclude with brief discussion of conic sections and coordinate transformations.

1. Review. (5 hours)

1.1 Limit, Continuity.
1.2 Derivability of functions of a single variable. Derivative rules and formulas.
1.3 Integration rules and standard integrals.

2. **Derivative (9 hours)**

2.1 Higher order derivatives.
2.2 Maxima and Minima.
2.3 Mean value theorems.
2.4 Taylor and Maclaurin series.
2.5 Tangent and Normal.
2.6 Curvature.
2.7 Asymptotes.
2.8 Curve tracing.

3 Antiderivatives. (12 hours)

3.1 Definite integrals.
3.2 Fundamental theorem of integral calculus.
3.3 Improper integrals.
3.4 Reduction formulae for integrals, Beta and Gamma functions,

4 Applications of Integral (8 hours)

4.1 Areas
4.2. Lengths
4.3 Volumes.
4.4 Surfaces

5 Ordinary differential equations (5 hours)

5.1 Differential equations of first and second orders.
5.2 Linear equations with constant cofficients.

6. Analytic Geometry of two dimensions (6 hours)

6.1 Translation and rotation of axes.
6.2 Parabola.
6.3 Ellipse.
6.4 Hyperbola.
6.5 Central conics.

Textbook

1. E.W. Swokowski, "Calculus With Analytic Geometry", Second Alternate Edition, PWS-Kent Publishing Co., Boston.

MATHEMATICS II

EG471SH

Lecture: 3 Year:1
Tutorial: 2 Part: B

COURSE OBJECTIVES: It is assumed that students have taken Mathematics I or an equivalent introduction to calculus as a prerequisite. Major topics to be covered are (a) two and three-dimensional vectors and some associated linear algebra (b) infinite series (c) first order differential equations.

1. **Plane curves and Polar coordinates.** **(4 hours)**

   1.1 Plane curves**.**
   1.2 Parametric equations.
   1.3 Polar coordinates.
   1.4 Integrals in Polar Coordinates.

2. **Calculus of Several Variables**. **(6 hours)**

   2.1 Calculus of two or more variables.
   2.2 Partial derivatives.
   2.3 Total differential coefficients.
   2.4 Extrema of functions of two or three variables.

3. **Multiple intergals.** **(4 hours)**

   3.1 Multiple intergals.
   3.2 Uses in areas.
   3.3 Volumes.
   3.4 Centroids.

4. **Analytic Geometry of 3-D** **(7 hours)**

   4.1 Analytic Geometry of three dimensions-planes.
   4.2 Straight lines.
   4.3 Standard equations of sphere.
   4.4 Cylinder and cone.

5. **Infinite series** **(9 hours)**

   5.1 Infinite series and sequences.
   5.2 Convergence
   5.3 Ratio, root, integral tests.
   5.4 Absolute convergence
   5.5 Power series.
   5.6 Radius of convergence.

6. **Vectors in two and three dimensions** **(5 hours)**

6.1 Two and three dimensional Vectors.
6.2 Scalar products.
6.3 Vector products
6.4 Linesand planes.

7. **OrdinaryLinear differential equations** **(10 hours)**

7.1 Homogeneous Linear differential equations of second order.
7.2 General solution.
7.3 Initial value problems.
7.4 Non homogeneous equations.
7.5 Solution in series, Legendre, Bessel equations.

Textbook:

1.0 E.W. Swokowski, "Calculus With Analytic Geometry", Second Alternate Edition, PWS-Kent Publishing Co., Boston.

Reference Books:

1.0 E. Kreyszig, "Advance Engineering Mathematics", Fifth Edition, Wiley, New York.

MATHEMATICS III
EG501SH

Lecture: 3 Year: II
Tutorial: 2 Part: A

COURSE OBJECTIVES: The purpose of this course is to round out the student's preparation for more sophisticated applications with an introduction to linear algebra, a continuation of the study of ordinary differential equations and an introduction to vector calculus.

1. **Matrices and determinants** **(8 hours)**
   - 1.1 Matrix and determinants.
   - 1.2 Vector spaces
   - 1.3 Linear transformations
   - 1.4 System of linear equations, Gauss elimination.
   - 1.5 Rank, matrix inversion.
   - 1.6 Eigen values, eigen vectors.

2 **Fourier series** **(4 hours)**
   - 2.1 Fourier series,
   - 2.2 Periodic functions
   - 2.3 Odd and even functions.
   - 2.4 Fourier series for arbitrary range.
   - 2.5 Half range Fourier series.

3. **Laplace transforms** **(8 hours)**
   - 3.1 Laplace transforms.
   - 3.2 Standard L- transforms.
   - 3.3 Inverse laplace transforms.
   - 3.4 Applications.

4 **Vector Calculus** **(7 hours)**
   - 4.1 Vector Calculus.
   - 4.2 Differentiation and Integration of Vectors.
   - 4.3 Divergence.
   - 4.4 Gradient curl.

5 **Line, surface and volume integrals** **(18 hours)**
   - 5.1 Line integrals.
   - 5.2 Surface and volume integrals.
   - 5.3 Integral transformation theorems- Stoke's, Gauss and Green's theorems.

Textbook:

1.0 E. Kreszig, "Advanced Engineering Mathematics", Fifth Edition, Wiley, New York.

2.0 M.M. Guterman and Z.N. Nitecki, "Differential Equations, a First Course", 2nd Edition, Saunders, New York.

PROBABILITY AND STATISTICS

EG571SH

Lecture: 3 Year: 2
Tutorial: 1 Part: B

Course Objectives: To provide the student with a practical knowledge of the principles and concepts of probability and statistics and their application to simple engineering problems.

1. **Introduction and Descriptive Statistics:** (4 hours)
   1.1. An overview of probability and statistics
   1.2. Pictorial and tabular methods in descriptive statistics
   1.3. Measures of location: mean, median, quartiles, percentiles, etc.
   1.4. Measures of variability

2. **Probability:** (4 hours)
   2.1. Sample spaces and events
   2.2. Axioms, interpretations and properties of probability
   2.3. Counting techniques
   2.4. Conditional probability
   2.5. Independence

3. **Discrete Random Variables and Probability Distributions:** (6 hours)
   3.1. Random variables
   3.2. Probability distributions for random variables
   3.3. Expected values of discrete random variables
   3.4. The binomial probability distribution
   3.5. The hypergeometric and negative binomial distributions
   3.6. The Poisson probability distribution

4. **Continuous Random Variables and Probability Distributions:** (6 hours)
   4.1. Continuous random variables and probability density functions
   4.2. Cumulative distribution functions and expected values
   4.3. The Normal Distribution
   4.4. The Gamma Distribution
   4.5. Chi-Squared Distribution

5. **Joint Probability Distributions and Random Samples:** (4 hours)
   5.1. Jointly distributed random variables
   5.2. Expected values, covariance and correlation
   5.3. Sums and averages of random variables
   5.4. The central limit theorem

6. **Point Estimation:** (2 hours)
   6.1. Some general concepts of point estimation
   6.2. Methods of point estimation

7. **Interval Estimation:** (3 hours)

7.1. Basic properties of Confidence Interval
7.2. Large-sample Confidence interval for population Mean and Proportion
7.3. A Confidence intervals for the mean of Normal Population
7.4. Confidence interval for the Variance and Standard Deviation of a Normal Population

8. **Hypothesis Testing Procedures Based on a Single Sample:** (5 hours)

8.1. Hypothesis and Test Procedure
8.2. Tests about the mean of a Normal Population
8.3. Large-sample Test for population mean
8.4. Large-sample Test for a population proportion
8.5. The t-test
8.6. Some comments on selecting a test procedure

9. **Hypothesis Testing Based on Two Samples:** (4 hours)

9.1. z-tests for differences between two population means
9.2. The sample t-test
9.3. Analysis of paired Data
9.4. Testing for differences between population proportions

10. **Simple Linear Regression and Correlation:** (4 hours)

10.1. The simple linear probabilistic model and principle of least square
10.2. Correlation, Correlation coefficient and coefficient of determination
10.3. Linear and non-linear Regression
10.4. Line of Regression and coefficient of Regression

11. **The Analysis of categorical Data**: (3 hours)
11.1. Goodness of Fit tests when category Probablilities are completely specified
11.1.1. Goodness of fit for composite Hypothesis
11.1.2. Two way contengency Tables

Textbook:

1.0 Jay L.Devore, “Probability and Statistics for Engineering and the Sciences”, Brooks/Cole publishing Company, Monterey, California, 1982.

Reference Book:

11 Murray R. Spiegel, "Theory and Problems of Probability and Statistics", McGraw Hill, Singapore
12 D. C. Sancheti and V. K. Kapoor, "Statistics", Sultan Chand and Sons, Educational Publishers, India
13 S. C. Gupta,"Fundamental of Statistics", Himalaya Publishing House, India
14 Jeetendra P. Aryal and Arun Gautam, "Quanatative Technique Vol. II", Vidhyarthy Pustak Bhandar, Nepal
15 S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Son, India

NUMERICAL METHODS
EG 601 SH

Lecture : 3 **Year : 3**
Practical : 3 **Part : A**

COURSE OBJECTIVES: To present the theory of numerical computational procedures for solving engineering problems. Solution of ordinary and partial differential equations will be included.

1.0 Solution of Nonlinear Equations: (10 hours)

1.1 Review of calculus, continuity, differentiability, intermediate value theorem, Taylor's theorem
1.2 Absolute, relative, and round off errors, error bounds for computational errors
1.3 Bisection method, its error bounds and convergence
1.4 Newton's method, secant method and their convergence properties
1.5 Fixed point iteration, its convergence properties, steffenson's algorithm
1.6 Zeros of polynomials by Horner's method

2.0 Interpolation and Approximation: (10 hours)

2.1 Taylor's polynomial approximation, Lagrange's interpolation
2.2 Newton's interpolation and divided differences
2.3 Interative interpolation
2.4 Cubic spline interpolation
2.5 Least squares method of fitting continuous and discrete data or functions

3.0 Numerical Differentiation and Integration: (5 hours)

3.1 Numerical differentiation formulas
3.2 Newton-Cote's numerical integration formulas, composite numerical integration
3.3 Romberg integration algorithm
3.4 Gaussian integration formulas

4.0 Linear Algebraic Equations: (10 hours)

4.1 Review of the properties of matrices
4.2 Matrix form of Gaussian elimination, pivoting strategies, ill-conditioning
4.3 Cholesky's and related algorithms for matrix factorization
4.4 Eigen values and eigen vectors and the power method

5.0 Solution of Ordinary Differential Equations: (7 hours)

5.1 Euler's method for solving ordinary differential equations of 1st order and other related methods.
5.2 Runge-Kutta methods
5.3 Extension to higher order equations
5.4 Initial value problems
5.5 Boundary value problems

6.0 Solution of Partial Differential Equations: (3 hours)

6.1 Introduction to the solution of partial differential equations
6.2 Engineering examples

Textbook:

1.0 S. Yakwitz and F. Szidarovszky, "An Introduction to Numerical Computations", 2nd Edition, Macmillan Publishing Co., New York.

Reference Books:

1.0 W. Chency and D. Kincaid, "Numerical Mathematics and Computing", 2nd Edition, Brooks/Cole Publishing Co., 1985

2.0 C.F. Gerald and P.O. Wheatley, "Applied Numerical Analysis", 4th Edition, Addison Wesley Publishing Company, New York.

Reference Book for Programs in C:

1.0 W.H. Press, B.P. Flannery et.al., "Numerical Recipes in C", 1st Edition, Cambridge Press, 1988.

CHEMISTRY

EG403SH

Lecture: 3 Year: I
Tutorial: 1 Part: A
Laboratory: 2

COURSE OBJECTIVES: To develop the basic concepts of Physical Chemistry, Inorganic Chemistry and Organic Chemistry relevant to problems in engineering.

Group A (Physical Chemistry)

1.0 Atomic Structure (5 hours)

1.1 Limitations of Bohr's Theory
1.2 Sommerfeld's extension of Bhor model of atom (no derivation)
Wave mechanical model of atom
1.3 De-Broglee's equation, matter waves and electromagnetic waves
1.4 Heisenberg's uncertainty principle, uncertainty principle and probability Concept.
1.5 Derivation of Schrodinger's equation (time Independent), significance of wave function, quantam numbers and orbital, radial and angular probability distribution graphs and shapes of s, p, d orbitals.
1.6 Pauli's exclusion principle, Hund's rule of maximum multiplicity aufbau principle, electronic configuration using s, p, d, f orbitals, stability of half filled and completely filled orbitals.

2.0 Ionic equilibrium (4 hours)

2.1 Strong and weak electrolytes
2.2 Ostwald's dilution law and its limitation
2.3 pH and pH scale
2.4 Common ion effect in ionic equilibria.
2.5 Buffer and PH of buffer

3.0 Flectro Chemistry (4 hours)

3.1 Electrolytic cells and Galvanic cells
3.2 Single electrode potentials and normal hydrogen electrode, elctro-chemical series
3.3 Nernst's equation and determination of electrode potential and cell potential under non-standard conditions
3.4 Corrosion of metals and its prevention.

4.0 Chemical energetics (5 hours)

4.1 Internal energy (E) and I law of thermodynamics.

4.2 Isothermal irreversible expansion of an ideal gas, isothermal reversible expansion of an ideal gas.
4.3 Experimental determination of E(using bomb Calorimeter)
4.4 Enthalpy (H) and experimental determination of H.
4.5 Enthalpy of Physical and Chemical changes
4.6 Hess's law of constant heat summation
4.7 Enthalpy change from bond energy
4.8 Molar heat Capacities, relation between Cp and Cv
4.9 Variation of heat of reaction with temperature (Kirchhoff's equations)
4.10 Calorific values of fuels and food.

Group B (Inorganic Chemistry)

5.0 Chemical Bonding (4 hours)

5.1 Valence bond theory
5.2 A brief treatment of the Covalent bond with valence bond theory.
5.3 Types of overlapping
5.4 Hybridization
5.5 Condition necessary for hybridization
5.6 Characteristic of hybrid orbitals
5.7 Types of hybridization - Sp, Sp^2, Sp^3, dsp^2, dsp^3 and d^2Sp^3

6.0 Co-ordination Complexes (5 hours)

6.1 Double Salt and complex Salt
6.2 Werner's Co-ordination theory
6.3 Nomenclature of Co-ordination Complexes.
6.4 Electronic interpretation in Co-ordination.
6.5 Bonding in Co-ordination compounds - only valence bond theory.
6.6 Applications of valence bond theory - Octahedral complexes, Tetrahedral complexes and Square planer complexes.
6.7 Application of Co-ordination complexes.

7.0 Transition elements - 3rd Series, with refrence to (5 hours)

7.1 Electronic configuration.
7.2 Metallic character
7.3 Oxidation State
7.4 Colour formation
7.5 Magnetic properties
7.6 Tendency to form complexes.

8.0 Silicones - Properties and uses (1 hour)

Group C (Organic Chemistry)

9.0 Stereochemistry (3 hours)

9.1 Stereoisomerism
9.2 Geometrical isomerim
9.3 Optical Isomerisum

10.0 Four general types of organic reactions (4 hours)
10.1 Substitution reaction S_N^1 and S_N^2 reaction
10.2 Addition
10.3 Elimination E_1 and E_2 reactions
10.4 Rearrangement.

11.0 Organometallic campounds (1 hours)

Preparation of Grignard's reagent, properties and uses

12.0 Aromatic Campounds (1 hours)

Toluene- preparation, Properties and uses

13.0 Explosives (2 hours)
13.1 Simple idea about low and high explosives.
13.2 TNT, TNG and nitrocellulose preparation and uses

14.0 Plastics and Polymers (3 hours)
14.1 Polymers and Polymerization.
14.2 Types of Polymerization reaction.
14.3 Types of Polymers
14.4 Syntnetic fibres Polystyrene, teflon, nylon, terylene or dacron.

Text books and References.

Physical Chemistry:

Text:
1. Selected topics in physical chemistry.
-Motikaji Sthapit

References:
1. Principles of physical chemistry
-Marron & Prutton.
2. Essentials of physical chemistry.
-Bahl & Tuli

Inorganic chemistry:

Text:
1. Advanced Inorganic chemistry
- Satyaprakash, R.D.Modan.,G.D. Tuli

References:

1. Concise Chemistry
   -A.J. Lee
2. Inorganic chemistry
   -R.C.Agrawal.

Organic chemistry:

Text:

1. Organic chemistry**.**
   -Morrison and Boyd

References:

1. Organic chemistry
   -B.S.Bahl
2. Mechanisum in organic chemistry
   -Peter Sykes.

Chemistry Laboratory

EG403SH

F M:25
Internal: 10
External: 15

1. To determine the alkalinity of water samples A&B.

2. To determine the hardness of water Complexometrically using EDTA.

3. To determine the amount of free chlorine in water by Standardization of hypo Solution.

4. To prepare the standard buffer solutions using acetic acid & sodium acetate and to measure the approximate pH of the given unknown solution by universal indicator method.
5. To prepare the standard buffer solutions using ammonia and ammonium chloride and to measure the approximate pH of the given unknown solution by using universal indicator indicator.

6. To determine the relative and absolue viscosity of the given liquids by ostwald's Viscometer.

7. To find the surface tension of the liquids by stalagmometer and compare surface tension of the cleaning powder of detergents.

8. To measure the quantity of electricity required to deposite one mole of Copper.

9. To purify petroleum and crude alcohol by fractional distillation.

PHYSICS
EG 472 SH

Lecture: 4 Year: I
Tutorial: 1 Part: B
Practical: 2

Objectives: To provide the concept and knowledge of physics with the emphasis of present day applications. The background of physics corresponding to Proficiency Certificate Level is assumed.

1.0 Oscillations and Simple Harmonic motion (3 Hours)

1.1 Introduction to mean position and restoring force. Elastic restoring force. Hooks Law. Definition of SHM. Condition of SHM. Rarity of SHM'S. Equation of SHM.

1.2 Examples of SHM: spring-mass system, Physical pendulum and torsional pendulum.

1.3 Damped Oscillations. Equation of damped oscillator. Forced oscillation and resonance.

2.0 Wave in Elastic Media (6 Hours)

2.1 Introduction to the wave process. Types of waves (only introduction). Speed of transverse waves. Dependence of wave velocity from the properties of medium. Equation of wave process; Particle velocity and particle acceleration.

2.2 Energy power and intensity in wave motion. Standing waves and resonance.

3.0 Acoustics (7 Hours)

3.1 Sound waves. Propagation of sound wave in solids, liquids and gases (review). Pressure variation due to waves.

3.2 Energy considerations. Intensity, Intensity level and loudness. Decibel and phon. Introduction to the reflection, refraction, attenuation and diffraction of sound.

3.3 Auditorial acoustics. Reverberation of sound. Sabine's Law. Conditions for good auditorium and concert halls.

3.4 Doppler effect.

3.5 Ultrasound: Introduction and properties. Production of ultrasound by magnetostriction and piezoelectric methods. Uses of ultrasound in distance measurement, signalling. Non-destructive test of structures and materials.

4.0 Electrostatics (8 Hours)

4.1 Electric charge. Coulomb's law of electrostatic field. Lines of force. Calculation of electric field due to dipole, quadrupole, charged ring and linear charge.

4.2 Electric flux. Gauss' Law and its application to charges dielectric sphere.

4.3 Electric potential. Potential, field strength and potential gradient. Potential due to a point charge.

4.4 Potential due to dipole and quadrupole. Electrostatic potential energy.
4.5 Capacitors: Parallel plate capacitor, cylindrical capacitor, spherical capacitor.
4.6 Effect of dielectrics. Determination of relative dielectric Permitivity. Conductors and dielectrics in electric field. E and D fields. Energy stored in electric field. Energy density.
4.7 High intensity electrostatic fields. Uses of static electric fields in Xeroxing and precipitation. Hazard of strong electrostatic fields: lightning.

5.0 Direct current (3 Hours)

5.1 Current and current density. Current flow in solid, liquid and gases. Ohm's law. Resistance's in series and in parallel.
5.2 Kirchhoff's Laws.
5.3 Atomic view of resistivity. Current flow in semiconductors and metals. Temperature dependence of resistivity.
5.4 Energy loss in circuit. Joule's Law of heating effect. Long distance transmission lines.
5.5 Charging and discharging of a capacitor through a resistor. Time constant.

6.0 Magnetism and Magnetic fields. (7 Hours)

6.1 Source of Magnetic fields: Current and permanent magnets. Terrestrial magnetism. Lines of force. Flux of magnetic field and permeability.
6.2 Biot and Savart's law and its application to long straight wire and circular current loop. Amperes theorem and its application to long straight conductor, solenoid and toroid carrying current.
6.3 Magnetic scalar potential and potential gradient.
6.4 Force on moving charge on magnetic field. Hall effort. Force on conductor in magnetic field. Force per unit length between parallel conductors carrying current.
6.5 Faraday's law of electromagnetic induction. Flux linkage. Lenz's law. Self-induction. Calculation of the coefficient of self-induction for solenoid and toroid.
6.6 LR circuit. Energy stored in magnetic field. Energy density of magnetic field.
6.7 H, B and fields.

7.0 Electromagnetic Oscillations (7 Hours)

7.1 LC oscillations. Analogy to SHM.
7.2 Electromagnetic oscillations of LCR circuit. Forced oscillation of LCR circuit and resonance.

8.0 Electromagnetic waves (4 Hours)

8.1 Equation of continuity as the law of conservation of electric charge. Maxwell equations in integral and differential forms.
8.2 Displacement current and its significance.
8.3 Application of Maxwell equations: wave equations in free space and non-conducting medium.

8.4 Speed of electromagnetic waves. Energy of electromagnetic wave. Poynting vector.

9.0 Optics (15 Hours)

9.1 Introduction to light: Light as EM wave. Geometrical and wave optics. (Concepts only). Review of refraction through lenses. Combination of two lenses separated by distance. Cardinal points. Achromatic combination of two lenses separated by distance

9.2 Monochromatic aberration of lenses. Spherical aberration, astigmatism, coma, curvature of field and distortion. Causes and their minimization.

9.3 Fibre Optics: Introduction to optical fibres as medium for guiding a wave. The meaning of self focussing in optical fibres. Types of optical fibres according to the variation of refractive index within the optical fibres: single mode and multi mode. Uses of laser light in communication.

9.4 Lasers: principle of the generation of laser light. Basic differences of laser light from ordinary light: beam size, non-divergence, and high degree of monochromaticity and coherence. Uses of laser: industrial, medical and communication.

9.5 Interference. Introduction and mathematical theory. Coherent sources. Causes of non-coherence. Examples of the division of wavefront and amplitude. Interference in thin films and wedges. Fringes of equal inclination and fringes of equal thickness. Non-reflecting films. Newton's rings. Uses of interference in analysing the variation of thickness.

9.6 Diffraction: Introduction. Difference between Fresnel and Fraunhoffer diffraction. Difference between interference and diffraction pattern. Explanation of the variation of intensity due to single slit. Diffraction grating. Resolving power to diffraction gratings.

9.7 Polarisation: Visual explanation of polarization wave. Introduction to polarised and non-polarised light. Methods for obtaining polarised light. Malus' Law. Linearly, elliptically and circularly polarized light. Double refraction. Ordinary and extraordinary rays. Positive and negative crystals. Quarter and half-wave plates. Uses of polarised light in stress analysis. Optical activity. Specific rotation. Uses of optical activity in cahharimetry and detection of adulteration.

Text Books:

1 Haliday, Resnick and Walker, "**Fundamentals of Physics**", Fourth Edition, John Wiley and Sons 1988, 1993 and later editions.

2 A.S. Vasudeva, "**Modern Engineering Physics**", S-Chand & Co 1998, Delhi.

3 Robert Resnick and David Halliday, "**Physics: Part I and II**", 20th Edition, Wiley Eastern Limited, 1985.

Reference Books:

1 Subramanyam and Brij Lal, "**Optic**s" S-Chand & Co 1994, 1995 Delhi.

2 A.S. Vasudeva, "**Concept of Modern Engineering Physics**", S-Chand & Co 1998, Delhi.

Laboratory:

1.0 Vibrating string.
2.0 Resonance tube
3.0 Geometrical optics.
4.0 Interference, difference and polarization.
5.0 Electrostatics.
6.0 Field mapping.

COMMUNICATION I
(English)
EG404SH

Lecture: 1 Year:1
Tutorial: 3 Part: A

Course Description:

This course is designed for the students of B.E. Level who have completed either Diploma Level in Engineering or I. Sc. It intends to develop and strengthen in them the basic communication skills in the English language with emphasis on reading, writing and speaking.

Course Objectives:

This course intends to develop:

- ability to use language laboratory facility for the practice of listening pronunciation and oral development.
- intensive reading skills in technical and non-technical reading materials.
- skills in writing memoranda, business letters, applications and proposals.

:

1. **Introduction to pronunciation** **(2 Hours)**
   - 1.1 Phonetic symbols: vowels, diphthongs and consonants.
   - 1.2 Stress: word and connected speech.
   - 1.3 Intonation
   - 1.4 Practice in listening and speaking :
   - 1.5 Effective listening and note taking.
   - 1.6 Telling personal experience and simple incidents.
   - 1.7 Delivering speech with notes and visual aids.

2. **Intensive reading:** **(9 Hours)**
   - 2.1 Comprehension
   - 2.2 Understanding: short questions answer
   - 2.3 Contextual grammar

3. **Writing:** **(2 Hours)**
   - 3.1 Memoranda
   - 3.2 Business letters
   - 3.3 Application letters
   - 3.4 Proposals

Evaluation Scheme:

A) **Internal Assessment:**

Proposal writing -	6 marks
Lab -	2 marks
Attendance -	2 marks
Total:	**10 marks**

B) **Semester Exam**:

Comprehension -	14 marks
Short questions answer and contextual grammar -	10 marks
Proposal writing or	
Business letter / Application -	8 marks
Memo -	4 marks
Stress / Intonation -	4 marks
Total	**40 marks**
Total (A + B)	**50 marks**

Reference Books:

1.0 Anne Eisenberg, "Effective Technical Communication", McGraw - Hill. 1982.
2.0 K.W. Hope and T.E. Pearsall, "Reporting Technical Information", 5th Edition Macmillan Publishing Company, New York, 1984.
3.0 G. M. Spankie - "English in use." 1975
4.0 John Swales - "Writing Scientific English" - 1971
5.0 JMcAllister Gmadama - "English for Electrical Engineers" -1976
6.0 Alan Mounfford - "English in Workshop Practice"
7.0 Eric H. Glending - " English in Mechanical Engineering" - 1974
8.0 Geoffrey Leech Jan Svartvik -"A Communicative Grammar of English"

COMMUNICATION II
(English)
EG474SH

Lecture: 1 Year:1
Tutorial:3 Part: B

Course Description:

This course is designed for the B.E. Level I year II part students of Civil, Mechanical and III year I part students of Electrical, Electronics and Computer. It intends to develop and strengthen in students the communication skills in the English language with emphasis on writing, reading and speaking.

Course Objectives:

This course intends to develop skills in:
- understanding and using varieties of English.
- public speaking and mass communication.
- preparing and conducting meeting.
- faster / extensive reading.
- writing description, technical talk, seminar paper.
- writing technical reports.

1. **Varieties of English**: **(Lecture 1)**
   - 1.1 British / American.
   - 1.2 Formal / Informal.
   - 1.3 Spoken / Written.
   - 1.4 Polite / Familiar and Impersonal.

2. **Mass communication:**
   - 2.1 Presentation of talk
   - 2.2 Presentation of seminar paper.
   - 2.3 Conduction of meeting.

3. **Extensive reading** **(Lecture 4)**
   - 3.1 Scanning
   - 3.2 Skimming

4. **Writing** **(Lecture 10)**
   - 4.1 Writing description: Landscape, technical processes, mechanical / electrical objects, maps, graphs, charts.
   - 4.2 Preparing note and writing talk.
   - 4.3 Writing seminar paper
   - 4.4 Writing agenda, minute and notice.
   - 4.5 Writing technical reports.

Evaluation Scheme:

A)	**Internal Assessment:**	
	Report writing -	4 marks
	Technical talk / Seminar paper or meeting -	4 marks
	Attendance -	2 marks
	Total:	**10 marks**
B)	**Semester Exam:**	
	Varieties -	4 marks
	reading -	8 marks
	Description writing -	4 marks
	Seminar paper / talk -	8 marks
	Meeting -	6 marks
	Report writing -	10 marks
	Total:	**40 marks**
	Total (A + B)	**50 marks**

Reference Books:

1.0 Anne Eisenberg, "Effective Technical Communication", McGraw - Hill. 1982.

2.0 K.W. Hope and T.E. Pearsall, "Reporting Technical Information", 5th Edition Macmillan Publishing Company, New York, 1984.

ENGINEERING DRAWING I
EG 433 ME

Lecture : 1 **Year : 1**
Practical : 3 **Part : A**

COURSE OBJECTIVES: To develop basic projection concepts with reference to points, lines, planes and geometrical solids. Also to develop sketching and drafting skills to facilitate communication.

1.0 Instrumental Drawing, Practices and Techniques: (2 hours)

1.1 Equipment, and Materials:
Description of drawing instruments, auxiliary equipment and drawing materials

1.2 Techniques of Instrument Drawing:
Pencil sharpening, securing paper, proper use of T-squares, triangles, scales, dividers, compasses, erasing shields, French curves, linking pens

2.0 Freehand Technical Lettering: (4 hours)

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

3.0 Dimensioning: (8 hours)

3.1 Fundamentals and Techniques:
Size and location dimensioning, SI conventions
Use of scales, measurement units, reducing and enlarging drawings

3.2 General Dimensioning Practices:
Placement of dimensions, aligned and unidirectional
Recommended practice, some 50 items

4.0 Applied Geometry: (5 hours)

4.1 Plane Geometrical Construction:
Bisecting and trisecting lines and angles, proportional division of lines, construction of angles, triangles, squares, polygons. Constructions using tangents and circular arcs. Methods drawing standard curves such as ellipses, parabolas, hyperbolas, involutes, spirals, cycloids and helices (cylindrical and helical)

4.2 Solid Geometrical Construction:
Classification and pictorial representation of solid regular objects such as:
Prisms: Square, cubical, triangular and oblique
Cylinders: right and oblique
Cones: right and oblique
Pyramids: square, triangular, oblique, truncated
Doubly-Curved and Warped Surfaces: Sphere, torus, oblate ellipsoid, conoid, serpentine, paraboloid, hyperboloid

5.0 Basic Descriptive Geometry: (8 hours)

5.1 Introduction:
Application of descriptive geometry principles to the solution of problems involving positioning of objects in three-dimensional space
5.2 The Projection of points, lines and planes in space
5.3 Parallel lines
5.4 True length of lines: horizontal, inclined and oblique lines
5.5 Perpendicular lines
5.6 Bearing of a line
5.7 Point view or end view of a line
5.8 Shortest distance from a point to a line
5.9 Principal lines of a plane
5.10 Edge view of plane
5.11 True shape of an oblique plane
5.12 Intersection of line and a plane
5.13 Angle between a line and a plane
5.14 Angle between two intersecting lines
5.15 Angle between two non-intersecting (skew) lines
5.16 Dihedral angle between two planes
5.17 Shortest distance between two skew lines

6.0 Theory of Projection Drawing: (5 hours)

6.1 Perspective projection drawing
6.2 Orthographic projection
6.3 Axonometric projection
6.4 Oblique projection
6.5 First and third angle projection
6.6 Systems and projection

7.0 Multiview Drawings: (5 hours)

7.1 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
7.2 Orthographic Drawings:
Making an orthographic drawing
Visualizing objects from the given views
Interpretation of adjacent areas
True-length lines
Representation of holes
Conventional practices

8.0 Sectional Views: (4 hours)

8.1 Full section view
8.2 Half section
8.3 Broken section
8.4 Revolved section

8.5 Removed (detail) sections
8.6 Phantom of hidden section
8.7 Auxiliary sectional views
8.8 Specifying cutting planes for sections
8.9 Conventions for hidden lines, holes, ribs, spokes

9.0 Auxiliary Views: (5 hours)

9.1 Basic concept and use of auxiliary views
9.2 Drawing methods and types of auxiliary views
9.3 Symmetrical and unilateral auxiliary views
9.4 Projection of curved lines and boundaries
9.5 Line of intersection between two planes
9.6 True size of dihedral angles
9.7 True size and shape of plane surfaces

10.0 Freehand Sketching and Visualization: (5 hours)

10.1 Sketching and design
Value of sketching as part of design
10.2 Techniques of sketching:
Pencil hardness, squared paper, line densities
Techniques for horizontal, vertical and circular lines
10.3 Multiview sketches:
Choice of views, adding detail, dimensioning, title, notes
10.4 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

11.0 Developments and Intersections: (9 hours)

11.1 Developments:
General concepts and practical considerations
Development of a right or oblique prism, cylinder, pyramid, and cone
Development of a truncated pyramid and cone
Triangulation method for approximately developed surfaces
Transition pieces for connecting different shapes
Development of a sphere
11.2 Intersections:
Lines of intersection of geometric surfaces
Piercing point of a line and a geometric solid
Intersection lines of two planes
Intersection of prisms and pyramids
Intersection of a cylinder and an oblique plane
Intersection of a sphere and an oblique plane
Constructing a development using auxiliary views
Intersection of two cylinders

Intersection of a cylinder and a cone

DRAWING LABORATORY: 3 hours/week, 13 weeks

1.0 Freehand Technical Lettering and Use of Drawing Instruments
2.0 Freehand Technical Lettering and use of Drawing Instruments (cont.)
3.0 Dimensioning
4.0 Geometrical and Projection Drawing
5.0 Descriptive Geometry
6.0 Descriptive Geometry
7.0 Projection and Multiview Drawings
8.0 Projection and Multiview Drawings
9.0 Sectional Views
10.0 Auxiliary Views
11.0 Freehand Sketching and Visualization
12.0 Developments and Intersections
13.0 Developments and Intersections (cont.)

Textbooks and Reference Books:

1.0 W.J. Luzadder, "Fundamentals of Engineering Drawing", Prentice Hall, 8th Edition, 1981.
2.0 T.E. French, C.J. Vierck and R.J. Foster, "Engineering Drawing and Graphic Technology", McGraw-Hill, 1981.
3.0 F.E. Giesecks, A. Mitchell, H.C. Spencer and J.T. Dygdone, Macmillan, 8th Edition, 1986.

ENGINEERING DRAWING II
EG 483 ME

Lecture : 1 **Year : 1**
Practical : 3 **Part : B**

COURSE OBJECTIVES: To continue ENGINEERING DRAWING I to the point of producing intelligible working drawings.

1.0 Pictorial Drawings: (12 hours)

1.1 Introduction
Characteristics, advantages and disadvantages
1.2 Axonometric Projection
Isometric
Dimetric and trimetric drawing
1.3 Oblique projection
1.4 Perspective projection

2.0 Design and Production Drawings-Machine Drawings: (12 hours)

2.1 Introduction
Production of complete design and assembly drawings
2.2 Fundamental techniques
Size and location dimensioning
Placement of dimension lines and general procedures
Standard dimensioning practice (SI system)
2.3 Limit Dimensioning
Nominal and basic size, allowance, tolerance, limits of size, clearance fit, interference fit
Basic hole system and shaft systems
2.4 Threads and Standard Machine Assembly Elements
Screw threads: ISO standards, representation and dimensioning
Fasteners: Types and drawing representation
Key, collars, joints, springs bearings
2.5 Assembly Drawings
Drawing layout, bill of materials, drawing numbers

3.0 Welding and Riveting: (4 hours)

3.1 Representing Joints and Welds for Gas, Arc and Resistance Welding
Types: spot, seam, flash, fillet, back-back, surface and upset welds
3.2 Drawing symbols for welds
3.3 Rivets and riveted joints
Types and drawings representation

4.0 Piping Diagrams: (4 hours)

4.1 Piping, Tubing and Types of Joints
4.2 Specification of Threads, Fittings and Valves
4.3 Standard Piping Symbols
4.4 Piping Drawings and Symbolic Diagrams

5.0 Structural Drawings: (8 hours)

5.1 Steel Construction
- Structural steel shapes
- Bolted, welded and riveted connections
- Detailing practices for structural steel

5.2 Wood Construction
- Timber connections and bolted joints
- Detailing practice

5.3 Concrete Construction
- Slab and beam configurations
- Steel reinforcement and prestressing

5.4 Masonry and Stone Construction

6.0 Electrical and Electronic Diagrams: (8 hours)

6.1 Standards

6.2 Types of Diagrams
- Line diagrams, schematics and pictorials

6.3 Symbols for Components

6.4 Printed Circuits

6.5 Integrated Circuits

7.0 Topographical Drawings: (4 hours)

7.1 Topographical Maps

7.2 Cadastral Maps

7.3 Engineering Maps

8.0 Graphs, Charts and Nomograms: (4 hours)

8.1 Rectangular Coordinate Graphs

8.2 Charts

8.3 Nomograms

9.0 Reproduction and Duplicating of Engineering Drawings: (4 hours)

9.1 Blue Prints, Brown Prints and Blue-Line Prints

9.2 Ozalid Prints, Black and White (Diazo Prints)

9.3 Xerox Prints

9.4 Duplicate Tracings

9.5 Photocopies

9.6 Microfilming

9.7 Glass Cloth for Layouts

Texts and/or References:

1. "Fundamentals of Engineering Drawing", W.J. Luzadder, Prentice Hall, 8th Edition, 1981
2. "Engineering Drawing and Graphic Technology", T.E. French, C.J. Vierck and R.J. Foster, McGraw Hill, 1981
3. "Technical Drawing", F.E. Giesecke, A. Mitchell, H.C. Spencer and J.T. Dygdone, Macmillan, 8th Edition, 1986

LABORATORIES: 3 hr/week, 12 weeks

1. Isometric and Oblique Drawings
2. Oblique Drawing
3. Perspective Drawing
4. Machine Drawings; Sizing and dimensioning
5. Machine Drawings; Detail drawings, dimensioning and tolerancing
6. Machine Drawing; Assembly drawing
7. Threads and Fasteners
8. Welding, Jointing and Piping
9. Structural Drawing
10. Structural Drawing (cont.)
11. Electrical and Electronics Diagrams
12. Electrical and Electronics Diagrams (cont.)
13. Topographical and Engineering Maps
14. Graphs, Charts and Nomograms

1.5. Drawing Reproduction and Duplication

WORKSHOP TECHNOLOGY I
EG 432 ME

Lecture : 1 **Year : 1**
Practical : 3 **Part : B**

COURSE OBJECTIVES: To provide instruction and practical workshop experience in basic machine shop metal-working operations.

1.0 Bench Tools and Basic Hand Operations: (8 hours)

1.1 Familiarization with tools and their use
1.2 Machinist's hammers
1.3 Types of screw drivers
1.4 Use and sharpening of punches, chisels, chippers and scrapers, scribers
1.5 Classification of files
1.6 Types of pliers and cutters
1.7 Types of wrenches: open end, box end, combination, adjustable, socket, offset, twelve point ratchet, strap wrench, pipe wrench, spanner wrenches, Allen wrenches
1.8 Hacksaws
1.9 Bench vises
1.10 Hand drills
1.11 Taps and dies
1.12 Hand shears
1.13 Rules, tapes and squares
1.14 Soldering and brazing equipment
1.15 Rivet types

2.0 Hand Working Operations: (8 hours)

2.1 Choice of blades and sawing techniques
2.2 Filing to obtain flat and parallel surfaces, square corners, roughing and finishing operations
2.3 Tapping holes and threading rods
2.4 Scribing layout patterns
2.5 Shearing and cutting sheet metal
2.6 Soldering
2.7 Safety
2.8 Riveting

3.0 Power Tools: (4 hours)

3.1 Power hacksaw
3.2 Horizontal cutoff band saw
3.3 Vertical band saw and cutting operations
3.4 Bench and hand-held grinders
3.5 Belt and disk sanders
3.6 Hand-held power drills
3.7 Safety aspects

4.0 Measuring and Gaging: (4 hours)

4.1 Semi-precision tools such as rules, scales, try squares, inside/outside clipers, depth gages, feeler gages

4.2 Precision tolls such as micrometers, vernier calipers, vernier height gages, telescoping gages, hole gages, bevel protractors, dial indicators, gage blocks and surface plates

5.0 Drills and Drilling Processes: (4 hours)

5.1 Types of drill presses
5.2 Work holding attachments and accessories
5.3 Cutting tools
5.4 Geometry and grinding of drill bits
5.5 Drilling, countersinking, reaming, lapping
5.6 Cutting speeds
5.7 Safety

6.0 Machine Tools: (12 hours)

6.1 General safety considerations
6.2 Physical construction and types of engine lathes
6.3 Facing and straight turning operations
6.4 Threading
6.5 Tool selection and feed rates
6.6 Applications of shapers
6.7 Types and construction of milling machines
6.8 Selection of milling machine cutters and accessories, operations
6.9 Grinding machines
6.10 Horizontal surface grinding
6.11 Plain cylindrical grinding

7.0 Material Properties: (8 hours)

7.1 Tool materials such as low, medium and high carbon steels, hot and cold rolled steels, alloy steels, carbide and ceramic materials

7.2 Heat treating methods for steels: hardening, tempering, annealing, normalizing, quenching

7.3 Non-ferrous materials such as brass, bronze, aluminium: comparative properties and machinability

8.0 Sheet Metal Work (4 hours)

8.1 Tools
8.2 Marking and layout
8.3 Bending and rolling operations
8.4 Cutting operations

9.0 Metal Joining: (8 hours)

9.1 Safety considerations
9.2 Soldering methods and practices
9.3 Brazing methods and materials
9.4 Practice of torch brazing
9.5 Oxygen-acetylene welding methods and practices

9.6 Selection of welding rods
9.7 Arc welding methods and practices
9.8 Resistance welding
9.9 Electric arc welding

Textbooks and References Books:

1.0 J. Anderson and E.E. Tatro, "Shop Theory", McGraw-Hill, 5th Edition, 1942.
2.0 O.D. Lascoe, C.A. Nelson and H.W. Porter, "Machine Shop Operations and Setups", American Technical Society, 1973.
3.0 "Machine Shop Practice - Volume I", Industrial Press, New York, 1971.
4.0 "Machine Shop Practice Volume II", Industrial Press, New York, 1971.
5.0 K. Oswald, "Technology of Machine Tools", McGraw Hill - Ryerson, 3rd Edition.
6.0 Oberg, Jones and Horton, "Machinery's Handbook", 23rd Edition, Industrial Press, New York.

Workshop Practice: 3 hours per week for 12 weeks

1.0 Bench tools and hand operations: measuring, marking, layout, cutting, filing, drilling tapping, assembly.
2.0 Bench tools and hand operations continues.
3.0 Power tools and drilling machines.
4.0 Measuring and gaging.
5.0 Engine lathe: basic operations such as facing, cutoff, plain turning, knurling.
6.0 Lathe work continuation: taper turning, drilling and boring.
7.0 Basic shaper operations.
8.0 Milling machine and/or surface grinder.
9.0 Sheet metal working.
10.0 Soldering and brazing
11.0 Gas welding.
12.0 Electric arc welding.

INTRODUCTION TO COMPUTERS & PROGRAMMING
EG 405 SH

Lecture : 2 **Year : 1**
Practical : 3 **Part : B**

COURSE OBJECTIVES: To develop a working knowledge of computer methods, systems, and languages. Emphasis will be placed on developing programming skills using FORTRAN.

1.0 Introduction: **(3 hours)**
- 1.1 History of computing and computers
- 1.2 System organization, log-in procedures, basic commands
- 1.3 Text editing and file concepts

2.0 Fortran Language: **(10 hours)**
- 2.1 Fortran 77 syntax and conventions
- 2.2 Variable and statement types
- 2.3 Fortran arithmetic
- 2.4 Sequential programs
- 2.5 If-then-else logic structures
- 2.6 Flow charts and pseudocodes
- 2.7 While and repeat loops
- 2.8 Series computation
- 2.9 Recursive computation
- 2.10 Iterative algorithms

3.0 Arrays: **(3 hours)**
- 3.1 Vectors, matrices, signals and images represented by arrays
- 3.2 Vector computations
- 3.3 Matrix computations

4.0 Input and Output: **(4 hours)**
- 4.1 Formatting input and output
- 4.2 Use of data files for input and output
- 4.3 Logical and character variables
- 4.4 Double precision and complex variables

5.0 Program Development: **(6 hours)**
- 5.1 Structured programming
- 5.2 Structure charts
- 5.3 Data Flow diagrams
- 5.4 Function and subroutine programs
- 5.5 Testing concepts
- 5.6 Documentation concepts

6.0 Computer Systems: **(4 hours)**
- 6.1 Computer hardware

6.2 Computer software
6.3 Word processing
6.4 Other computer languages such as C, Pascal, etc.

Laboratory:

12 laboratory exercises with assignments growing in complexity from entering and running a small given program to the development of fairly complex subroutines and programs for engineering applications.
The remaining 3 laboratory sessions will be used for examination routines.

Textbooks:

1.0 D.M. Etterj, "Structured Fortran 77 for Engineers and Scientists", 3rd Edition, Benjamin/Cummings, Redwood City, California, 1990.
2.0 R.N. Reddy and C.A. Ziegler, "Fortran 77 with Applications of Scientists and Engineers", West Publishing Company, St. Paul, 1989.
3.0 D.D. McCracken and W.I. Salmon, "Computing for Engineers and Scientists with Fortran 77", 2nd Edition, Wiley, New York, 1988.

ENGINEERING ECONOMICS
EG 666 CE

Lecture : 3 **Year : 3**
Tutorial : 1 **Part : B**

COURSE OBJECTIVES: To provide a knowledge of the basic tools and methodology of economic studies for evaluation engineering project in private industry, in the public sector and in the utilities area.

1.0 Introduction (3 hours)
- 1.1 Essential business and accounting terminology
- 1.2 Definition of cash flow
- 1.3 Economic systems

2.0 Cost Classification and Analysis (5 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

3.0 Interest and the Time Value of Money (6 hours)
- 3.1 Simple interest, compound interest, interest tables, interest charts
- 3.2 Present worth
- 3.3 Nominal and effective interest rates
- 3.4 Continuous compounding and continuous compounding formula
- 3.5 Interest calculations for uniform gradient

4.0 Basic Methodologies of Engineering Economic Studies (7 hours)
- 4.1 Present worth and annual worth methods
- 4.2 Future worth method
- 4.3 Internal rate of return method
- 4.4 Drawbacks of the internal rate of return method
- 4.5 External rate of return method
- 4.6 Minimum attractive rate of return method
- 4.7 The playback (payout) period method

5.0 Cast/Benefit Analysis (4 hours)
- 5.1 Conventional cost/benefit ratio
- 5.2 Modified cost/benefit ratio
- 5.3 Break-even analysis

6.0 Investment Decisions: (8 hours)
- 6.1 Comparison of alternatives having some useful life
- 6.2 Comparison of alternatives having different useful life
- 6.3 Comparison of alternatives including of excluding the time value of money
- 6.4 Comparison of alternatives using the capitalized worth method

6.5 Definition of mutually exclusive investment alternatives in terms of combinations of projects
6.6 Comparison of mutually exclusive alternatives

7.0 Risk Analysis: (4 hours)

7.1 Projects operating under conditions of certainty
7.2 Projects operating under conditions of uncertainty
7.3 Decision tree
7.4 Sensitivity analysis

8.0 Taxation System in Nepal: (3 hours)

8.1 Taxation law in Nepal
8.2 Depreciation rates for buildings, equipment, furniture, etc.
8.3 Recaptured depreciation
8.4 Taxes on normal gains
8.5 Taxes on capital gains

9.0 Demand Analysis and Sales Forecasting (5 hours)

9.1 Demand analysis
9.2 Correlation of price and consumption rate
9.3 Multiple correlation of price and consumption rate
9.4 Market research
9.5 Sales forecasting
9.6 Criteria for desirable sales forecasting procedures
9.7 Factors affecting accuracy of forecasting

Tutorials: 3 Assignments, 2 Quizzes, 3 Case Studies

Note:

The case studies will concentrate on economic analysis and selection of public projects, economic analysis and selection of private projects, risk analysis and demand analysis.

Textbook:

1.0 E.P. DeGramo, W.G. Sullivan and J.A. Bontadelli, 8th Edition, Macmillan Publishing Company, 1988.

References:

1.0 N.N. Borish and S. Kaplan, "Economic Analysis: For Engineering and Managerial Decision Making", McGraw-Hill.

PROJECT ENGINEERING
EG 706 CE

Lecture : 3 **Year : 4**
Tutorial : 1 **Part : A**

COURSE OBJECTIVES: To provide the student with the fundamental concepts of initiating, planning, scheduling and controlling projects.

1.0 Introduction: **(3 hours)**
- 1.1 Project definition
- 1.2 Setting project objectives and goals
- 1.3 Project phases, project life cycle

2.0 Project Planning and Scheduling: **(18 hours)**
- 2.1 Planning function
- 2.2 Network models - CPM/PERT
- 2.3 Project scheduling with limited resources
- 2.4 Wiest's algorithms
- 2.5 Manpower levelling
- 2.6 Multiproject scheduling
- 2.7 Materials scheduling
- 2.8 Mathematical programming for minimum cost or maximum project return (simplex technique for linear programming)

3.0 Project Monitoring and Control: **(10 hours)**
- 3.1 Systems of control
- 3.2 Project control cycle
- 3.3 Feedback control systems
- 3.4 Cost control
- 3.5 Work breakdown structure
- 3.6 Introduction to project management information systems

4.0 Capital Planning and Budgeting: **(10 hours)**
- 4.1 Capital planning procedures
- 4.2 Preparation of operating budgets
- 4.3 Fixed and flexible budgets
- 4.4 Introduction to budgetary control

5.0 Impact Analysis: **(4 hours)**
- 5.1 Social impact analysis
- 5.2 Environmental impact analysis
- 5.3 Economic impact analysis

Textbook:

1.0 Arnold M. Ruskin and W. Eugene Estes, "Project Management", Marcel Dekker Publishers, 1982.

2.0 Joseph J. Moder and Cecil R. Phillips, "Project Management with CPM and PERT", Van Nostrand Reinhold Publishers, Latest Edition.

References:

1.0 L.S. Srinrath, "Pert and Application", East-West Press.
2.0 A. Bhattacharyya and S.K. Sorkhel, "Management by Network Analysis", The Institution of Engineers (India).
3.0 Prasanna Chandra, "Projects: Preparation, Appraisal, Implementation", Tata McGraw-Hill Publishing Company Ltd., New Delhi.

ENGINEERING PROFESSIONAL PRACTICE
EG 766 CE

Lecture : 2 **Year : 4**
Part : B

COURSE OBJECTIVES: To introduce the ethical and legal environment in which engineering is practiced.

1.0 Background Perspective: (6 hours)

1.1 Impacts and consequences of technology on society: effects of major technological development such as printing, gunpowder, mechanization, computers, organic chemistry, communication satellites
1.2 Cultural motivations and limitations, eastern vs western philosophy of change and development
1.3 Political and social limitations
1.4 Individual freedoms vs societal goals
1.5 Exponential growth
1.6 Alternative use of scarce resources, causes of international tensions
1.7 Risk and overall cost/benefit ratio analysis in engineering decision making
1.8 Education and training of technologists, scientists and engineers

2.0 Ethics and Professionalism: (3 hours)

2.1 Perspective on morals, ethics and professionalism
2.2 Codes of ethics and guidelines for professional engineering practice
2.3 Relationship of the engineering profession to basic science and technology; relationship to other professions

3.0 Roles of Professional Associations: (1 hour)

3.1 Regulation of the practice of the profession, licensing, guidance for training new entrants into the profession, advice and assistance to engineering colleges, upgrading and maintaining the professional and technical competence of member, providing technical expertise as requested for the guidance and assistance of legislators, seeing to the matter of safety and general welfare of the public in engineering works

4.0 Legal Aspects of Professional Engineering in Nepal: (9 hours)

4.1 The Nepalese legal system as it affects the practice of engineering
4.2 Provision for private practice and for employee engineers
4.3 Contract law
4.4 Tendering
4.5 Contract documents
4.6 Liability and negligence
4.7 Business and labour laws
4.8 Relationship to foreign firms working in Nepal

5.0 The Roles and Practice of Professional Engineering in Other Countries:(2 hours)

5.1 Other Asian countries

5.2 The USSR and Eastern Europe
5.3 Western Europe
5.4 North America

6.0 Case Studies Involving Professional Ethical Issues Chosen From a Wide Range of Topics: (9 hours)

6.1 Intellectual property rights: copyrights and patent protection
6.2 Personal privacy and large computerized data bases
6.3 Industrialization vs protection of the environment
6.4 Risk/benefit considerations in public transportation
6.5 Engineers and the military
6.6 Science and technology for medicine
6.7 Engineers in international development

Reference Book:

1.0 Carson Morrison and Philip Hughes, "Professional Engineering Practice - Ethical Aspects", McGraw-Hill Ryerson Ltd., Toranto, 1982.

DETAILED SYLLABUS OF

DEPARTMENTAL COURSES

COURSES IN STRUCTURAL AND APPLIED MECHANICS

The mechanics and structural engineering courses are aimed at preparing the students to understand the mechanics of structures, and then analyse and design these structures to carry the loads for which they are designed.

The techniques and concepts used in these courses are up-to-date to provide accurate analyses and modern designs that are aesthetically appealing and are, at the same time, safe and economical.

The course topics will be wide in scope to generate interest so that students can pursue further reading on their own, accrue deeper understanding of the wide field of structural engineering and follow future developments in the field.

The courses include methods for determining forces and stresses in the conventional structural systems and their components. The design courses will then allow the students to design structures made or reinforced concrete, steel and timber. An introduction to the design of prestressed concrete structures will also be included.

Laboratory experiments are incorporated, wherever appropriate, to argument and illustrate theoretical concepts in structural mechanics, analysis and design. This will further consolidate the students' understanding o the behaviour of structures and will generate interest for working or doing research in the field of structures.

Also, weekly tutorials that include assignments are incorporated in the program to allow students to solve problems and get assistance on an individual basis.

The mechanics and structural courses will span over the full four years of the degree program.

APPLIED MECHANICS I (STATICS)
EG 441 CE

Lecture : 3 Hours **Year : 1**
Laboratory :1.5 Hours **Part : 1**

		HOURS
1.0	**Introduction**	**1**
1.1	Engineering Mechanics - Definition and Scope	
1.2	Rigid, Deformed and Fluid Bodies	
1.3	Introduction to the Concept of Statics	
2.0	**Statics of Particles**	**2**
2.1	Concept of Particle	
2.2	Principles of Force	
2.3	System of Units	
3.0	**Statics of Rigid Bodies**	**3**
3.1	Concept of a Rigid Body	
3.2	Free Body Diagrams	
3.3	Equilibrium in Two-Dimensions	
4.0	**Introduction to Vector Algebra**	**6**
4.1	Vector and Scalar Quantities	
4.2	Addition and Subtraction of Vectors	
4.3	Laws of Vectors	
4.4	Scalar (Dot) Product	
4.5	Vector (Cross) Product	
4.6	Unit Vector in Cartesian Co-ordinates	
4.7	Scalar Triple Product	
4.8	Vector Triple Product	
5.0	**Forces on Particles and Rigid Bodies**	**7**
5.1	Characteristics of Forces	
5.2	Types of Forces	
5.3	Transmissibility and Equivalent Forces	
5.4	Resolution and Composition	
5.5	Movement of a Force About a Point	
5.6	Movement of a Force About a Axis	
5.7	Theory of couples	
5.8	Resolution of a Force into a Force and a Couple	
5.9	Resultant of a System of Forces	
6.0	**Distributed Forces**	**2.5**
6.1	Centres of Gravity	
6.2	Centroids of Lines, Areas and Volumes	
6.3	Second Moment of Area and Moment of Inertia	

7.0 Friction **2**

7.1 Introduction
7.2 Laws of Friction
7.3 Static Friction, Its Coefficient and Angle

8.0 Types of Structures **3**

8.1 Plane and Space Structures
8.2 Plane Trusses, Frames and Other Mechanisms
8.3 Machines

9.0 Analysis of Frames and Mechanisms **4**

9.1 Types of Frames, Statically Determinate or Indeterminate
9.2 Classification of Loads and Supports
9.3 Determination of Internal Forces in Trusses
9.4 Methods of Joints and Selections

10.0 Analysis of Plane Trusses **5**

10.1 External and Internal Forces in Trusses
10.2 Boundary Conditions and Degrees of Freedom
10.3 Determination of Internal Forces in Trusses
10.4 Methods of Joints and Sections

11.0 Introduction to Space Trusses

11.1 Equilibrium of Concurrent Forces in Space
11.2 Tension Coefficients
11.3 Analysis of Simple Space Trusses
11.4 Shear Legs, Tripods, etc.

12.0 Analysis of Beams **6**

12.1 Classification of beams, Loads and Supports
12.2 External and Internal Forces in Beams
12.3 Shearing Force, Bending Moment and Axial Force Diagrams
12.4 Relationships Between Load, Shearing Force and Bending Moment

13.0 Forces on Submerged Surfaces **2.5**

13.1 Hydrostatics
13.2 Pressure Distributions and Values
13.3 Centroid of Pressure
13.4 Resultant Forces Due to Pressure

Tutorials:

12 assignments and two quizzes.

Textbook:

"Engineering Mechanics - Statics and Dynamics" Shames, I.H., 3rd ed., New Delhi, Prentice Hall of India, 1990.

Reference:

"Mechanics for Engineers - Statics and Dynamics", F.P. Beer and E.R. Johnston, Jr. 4th Edition, McGraw-Hill, 1987.

APPLIED MECHANICS II (DYNAMICS)
EG 491 CE

Lecture : 3 **Year : 1**
Tutorial : 1.5 **Part : B**

		HOURS
1.0	**Introduction to Dynamics**	**1**
2.0	**Rectilinear Motion of Particles**	**3**
2.1	Position, Velocity and Acceleration	
2.2	Determination of the Motion of Particles	
2.3	Uniform Rectangular Motion	
2.4	Uniformly Accelerated Rectilinear Motion	
2.5	Motion of Several Particles	
2.6	Graphical Solution of Rectilinear - Motion Problems	
3.0	**Curvilinear Motion of Particles**	**4**
3.1	Position Vector, Velocity and Acceleration Body	
3.2	Derivatives of Vector Functions	
3.3	Rectangular Component of Velocity and Acceleration	
3.4	Motion Relative to Frame in Translation	
3.5	Tangential and Normal Component	
3.6	Radial and Transverse Component	
4.0	**Kinetics of Particles: Newton's Second Law**	**6**
4.1	Newton's Second Law of Motion	
4.2	Linear Momentum and Rate of Change	
4.3	System of Units	
4.4	Equations of Motion and Dynamic Equilibrium	
4.5	Angular momentum and rate of change	
4.6	Equations of Motion - Radial and Transverse Components	
4.7	Motion Due to a Central Force - Conservation of Momentum	
4.8	Newton's Law of Gravitation	
4.9	Application to Space Mechanics	
5.0	**Kinetics of Particles: Energy and Momentum Methods**	**6**
5.1	Work Done by a Force	
5.2	Kinetic Energy of Particles	
5.3	Principles of Work and Energy: Applications	
5.4	Power and Efficiency	
5.5	Potential Energy	
5.6	Conservation of Energy	
5.7	Principle of Impulse and Momentum	
5.8	Impulsive Motion and Impact	
5.9	Direct Central Impact	
5.10	Oblique Impact	

6.0 Systems of Particles **6**

6.1 Newton's Laws and a System of Particles
6.2 Linear and Angular Moment for a System of Particles
6.3 Motion of the Mass Centre
6.4 Conservation of Momentum
6.5 Kinetic Energy of System of Particles
6.6 Work Energy Principle; Conservation of Energy for a System of Particles
6.7 Principle of Impulse and Momentum for a System of Particles
6.8 Steady Stream of Particles
6.9 Systems with Variable Mass

7.0 Kinematics of Rigid Bodies **7**

7.1 Introduction
7.2 Translation
7.3 Rotation
7.4 General Plane Motion
7.5 Absolute and Relative Velocity in Plane Motion
7.6 Instantaneous Centre of Rotation
7.7 Absolute and Relative Frame; Coriolis Acceleration in Plane Motion
7.8 Rate of Change of a General Vector with Respect to a Rotating Frame; Coriolis Acceleration
7.9 Motion About a Fixed Point
7.10 General Motion
7.11 Three - Dimensional Motion of a Particle Relative to a Rotating Frame; Coriolis Acceleration

8.0 Plane Motion of Rigid Bodies: Forces, Moments and Accelerations 4

8.1 Equations of Motion for a Rigid Body
8.2 Angular Momentum of a Rigid Body in Plane Motion
8.3 Plane Motion of Rigid Body; D'Alembert's Principle
8.4 Applications of Rigid Body Motion in the Plane
8.5 Constrained Motion in the Plane

9.0 Plane Motion of Rigid Bodies: Energy and Momentum Methods 5

9.1 Principal of Work and Energy for a Rigid Body
9.2 Work done by External Forces
9.3 Kinetic Energy for a System
9.4 Conservative and Non-conservative Systems
9.5 Work - Energy Applications
9.6 Impulse and Momentum for Systems of Rigid Bodies
9.7 Conservation of Angular and Linear Momentum
9.8 Implusive Motion and Eccentric Impact

10.0 Mechanical Vibrations **3**

10.1 Undamped Free Vibrations of Particles and Rigid Bodies; Simple Harmonic Motion; Frequency and Period of Oscillation
10.2 Steady Harmonic Forcing of Undamped Systems

Tutorials:

12 assignments and two quizzes.

Textbook:

"Engineering Mechanics - Statics and Dynamics" Shames, I.H., 3rd ed., New Delhi, Prentice Hall of India, 1990.

Reference:

"Mechanics for Engineers - Statics and Dynamics", F.P. Beer and E.R. Johnston, Jr. 4th Edition, McGraw-Hill, 1987.

STRENGTH OF MATERIAL
EG 522 CE

Lecture : 3 **Year : 2**
Laboratory :1 **Part : A**
Tutorial : 1

		HOURS
1.0	**Introduction**	**4**
1.1	Types of Loads - Statics, Dynamic, Dead, Live, Wind and Seismic Loads	
1.2	Types of Supports and Their Symbolic Representations	
1.3	Types and Numbers of Reactions at the Supports	
1.4	Statically Determinate and Indeterminate Structures	
2.0	**Axial Forces, Shearing Forces and Bending Moments**	**7**
2.1	Review of Previous Work	
2.2	Plotting Shearing Force and Bending Moment Diagrams for Determinate Structures (Beams and Frames)	
2.3	The Concept of Superposition of Shearing Forces and Bending Members Due to Various Combinations of Loads	
2.4	Maximum Shearing Force and Bending Moment and Their Positions	
3.0	**Centroid of Plane Elements**	**3.5**
3.1	Review of Previous Work	
3.2	Determination of Axes of Symmetry	
3.3	Determination of Centre of Gravity of Built-Up Plane Figures	
3.4	Determination of Centre of Gravity of Built-Up Standard Steel Sections	
4.0	**Moment of Inertia**	**4**
4.1	Review of Previous Work	
4.2	Determination of Moment of Inertia of Standard and Built-Up Sections	
4.3	Polar Moment of Inertia	
4.4	Definition and Determination of Radius of Gyration	
4.5	Principal Moment of Inertia	
5.0	**Stresses and Strains**	**3**
5.1	Definition of Stresses and Strains	
5.2	Relationship Between Stresses and Strains	
5.3	Elastic and Elastoplastic Behavior Under Various Stress Loads	
6.0	**Types and Characteristics of Stresses**	**3**
6.1	Ultimate Stresses	
6.2	Allowable Stresses and Factors of Safety	
6.3	Stress Concentrations	
6.4	Elastic Constants	
7.0	**Stress and Strain Analysis**	**4.5**
7.1	Hooke's Law, Modulus of Elasticity, Poisson's Ratio and Modulus of Rigidity	

7.2 Principal Stresses and their Relationships to Normal and Shear Stresses
7.3 Mohr's Circle for Stress and Strain
7.4 Stresses Due to Change in Temperature

8.0 Thin-Waled Vessels **3**
8.1 Definition and Characteristics of Thin-wall vessels
8.2 Types of Stresses in Thin-walled vessels
8.3 Calculation of Stresses in Thin-walled vessels

9.0 Torsion **4**
9.1 Definition
9.2 Calculation of Torsional Moments in Elements
9.3 Calculation of Torsional Stresses
9.4 Elastic and Plastic Torsion

10.0 Theory of Flexure **6**
10.1 Analysis of Beams of Symmetric Cross-section
10.2 Coplanar and Pure Bending
10.3 Radius of Curvature, Flexural Stiffness
10.4 Elastic and Plastic Bending
10.5 Beam Deflections
10.6 Analysis of Composite Beams

11.0 Introduction to Buckling **3**
11.1 Definition of Buckling
11.2 Buckling of Columns
11.3 Buckling of Compression Members in Trusses

Laboratories:

Five Laboratory exercises will be performed in this course. These are:

(a) Show the studies three films regarding: (i) behavior of structural material; (ii) tensile and compressive forces on structures: and (iii) loads on structures.
(b) Material properties in uniaxial structures. (i) direct tensile test; (ii) simple bending test.
(c) Torsion test to determine modulus of rigidity.
(d) Principal strains and stresses; Stress/Strain concentration; Poisson's ratio.
(e) Column behavior and buckling

Tutorials:

12 assignments and two quizzes.

Textbook:

1 "Elements of Strength of Materials" S.P. Timoshenko and D.H. Young, 5th Ed., East-West Press Pvt. Ltd., 1987.

2 "Strength of Material", G.H. Ryder, 3rd Ed., Macmillian, ELBS, 1985.

3 "Mechanics of Material", E.P. Popov, 2nd Ed., New Delhi, Prentice Hall of India.

THEORY OF STRUCTURES I
EG 562 CE

Lecture : 3 **Year : 2**
Laboratory :1 **Part : B**
Tutorial : 2

HOURS

1.0 Introduction **3**
- 1.1 Types of Structure Based on Material Used
- 1.2 Linearly Elastic Structures
- 1.3 Non-Linearity in Structural Analysis
- 1.4 Computer Based Methods

2.0 Analysis by the Virtual Work Method **6**
- 2.1 Work and Complimentary work
- 2.2 Displacement of Beams and Frames by method of Real Work
- 2.3 Calculation of Real Work from Bending
- 2.4 Limitations of the Method of Real Work
- 2.5 Displacements by the Method of Real Work
- 2.6 Direct and Bending Effects
- 2.7 Temperature Effects, Length, Adjustments and Misfits
- 2.8 Combination of Different Effects

3.0 Analysis by the Strain Energy Method **3**
- 3.1 Strain Energy and Complementary Strain
- 3.2 Strain Energy due to Gradually and Suddenly Applied Direct Load: Dynamic Multipliers
- 3.3 Strain Energy due to Bending, Shear and Torsion

4.0 Deflection of Beams **6**
- 4.1 Difference Between Curvature, Slope and Deflection
- 4.2 Differential Equation of the Deflection Curve
- 4.3 Deflection by Method of Integration
- 4.4 Introduction to Macaulay's Method
- 4.5 Moment Area Method
- 4.6 Deflection by Conjugate Beam Method
- 4.7 Deflection by Strain Energy Method

5.0 Influence Lines for Simple Structures **11**
- 5.1 Introduction to Moving Static Loads
- 5.2 Concept of Influence Lines
- 5.3 Influence Line Diagrams for Reactions at the Supports
- 5.4 Influence Line Diagrams for Bending Moments and Shear Forces
- 5.5 Influence Line Diagrams for Forces in Member of Plane Trusses
- 5.6 Influence Line Diagrams for the Case of Indirect Load Applications (Panel Loadings)

5.7 Determination of Reactions, Bending Moments and Shear Forces From Influence Line Diagrams
5.8 Loading of Influence Line Diagrams Using Standard Load Trains
5.9 Most Critical Position of a Load on a Beam Span

6.0 Statically Determinate Arches and Frames 8

6.1 Types of Arches and Frames
6.2 Three-Hinged Structures with Support at Same
6.3 Determination of Support Reactions, Shearing Forces, Normal Forces and Bending Moments by Numerical Methods
6.4 Analysis of three-Hinged Arches by the Graphical Method
6.5 Influence Line Diagrams for Reactions, Bending Moments, Sharing Forces and Normal Forces in Three-Hinged Arches and Frames
6.6 Three-Hinged Arches and Frames with Supports at Different Levels

7.0 Suspension Cable Systems 8

7.1 Theory of Suspended Structures with Unstiffened Cables
7.2 Catenary and Parabolic Cables
7.3 General Cases of Parabolic Cables
7.4 Elements of a Simple Suspension Bridge
7.5 Stress Determination in Three-Hinged Stiffening Girder
7.6 Influence Line Diagrams
7.7 Tower Structures, Wind Cables and Ties (Introduction Only)

Laboratories:

Six Laboratory exercises will be performed in this course. These are:

(a) Influence Lines for beams and girders.
(b) Experimental Analysis of Plane frames.
(c) Measurement of reactions in three-hinged arches under different loading arrangements.
(d) Influence Lines for frames.
(e) Deflection of beam.
(f) Experimental analysis of suspension bridge.

Tutorials:

12 assignments and two quizzes.

Textbook:

"Elementary Structural Analysis", C.H. Norris, J.B. Wilbur and S. Utku, 3rd Ed., New York: McGraw-Hill Book Co., 1977.

Reference:

"Structural Mechanics", A. Darkov and Kuznetsov, Mir Publishers.

THEORY OF STRUCTURES II
EG 622 CE

Lecture : 4 **Year : 3**
Laboratory :1 **Part : A**
Tutorial : 2

HOURS

1.0 Indeterminate Structures **3**
- 1.1 Types of Indeterminate Structures
- 1.2 Static Indeterminacy
- 1.3 Kinematic Indeterminacy

2.0 Theorems of Displacements **2**
- 2.1 Betti's Law
- 2.2 Maxwell's Reciprocal Theorem
- 2.3 Castigliano's Theorems

3.0 Consistent Deformation Method **15**
- 3.1 General Principle
- 3.2 Appropriate Choice of Redundants
- 3.3 Compatible Equations
- 3.4 Use of Graphical Multiplication Method
- 3.5 Application to Statically Indeterminate Beams, Pin Jointed and Stiff Jointed Frames
- 3.6 Effect of Temperature and Adjustments
- 3.7 Application to Two-Hinged Parabolic Arches, Including Yield of Supports and Temperature Effects

4.0 Slope Deflection Method **7**
- 4.1 Derivation of slope Deflection Equation
- 4.2 Fixed End Effects
- 4.3 Rotational and Translational Effects
- 4.4 Modification to Slope Deflection Equation for Fixed Pinned Members
- 4.5 Analysis of Continuous Beams Including Settlement of Supports

5.0 Details of Moment Distribution Method **13**
- 5.1 Principle of the Method
- 5.2 Fixed-End Moments
- 5.3 Carry-Over, Stiffness and Distribution Factors
- 5.4 Application to Continuous Beams With Different End Conditions
- 5.5 Application to Frames Without Side Sway and with Different End Conditions
- 5.6 Application to a Continuous Beam with Know Settlement
- 5.7 Cases of symmetry and Anti-Symmetry
- 5.8 Frames With side Sway; Rotation of Joints
- 5.9 Final Bending Moment, Shear Force and Normal Force Diagrams for Continuous Beams and Frames

6.0 Influence Lines for Continuous Beams **5**

6.1 Direct Method of Drawing Influence Line Diagrams
6.2 Muller-Breslau Principle
6.3 Drawing Influence Line Diagrams by Muller-Breslau Principle

7.0 Introduction to Plastic Analysis **7**

7.1 Plastic Bending
7.2 Moment Curvature
7.3 Plastic Moment
7.4 Plastic Hinge
7.5 Application to Beams and Frames
7.6 Plastic Analysis of Simple Statically Indeterminate Beams and Frames

8.0 Introduction to Matrix Method **8**

8.1 Flexibility Matrix and Its Use for Simple Cases
8.2 Stiffness Matrix and its use for simple cases
8.3 Choice of Force or Displacement Method

Laboratories:

Three Laboratory exercises will be performed in this course. These are:

(a) Experimental Analysis of Tho-Hinged arches.
(b) Experimental Analysis of Continuous Beams.
(c) Experimental Analysis of a portal frame (symmetrical and unsymmetrical).

Tutorials:

5 assignments

Textbook:

"Intermediate Structural Analysis", Chu-Kin Wang, Auckland, McGraw-Hill International, 1989.

DESIGN OF STEEL & TIMBER STRUCTURES
EG 662 CE

Lecture : 4 **Year : 3**
Tutorial : 2 **Part : B**

		HOURS
1.0	**Steel Structures**	**2.5**
1.1	Types and Properties of Steel	
1.2	Stress-Strain Characteristics of Structural Steel	
1.3	Allowable Stresses in Structural Steel	
1.4	Use of Steel as a Structural Member in Construction	
1.5	Codes of Practice for Design of Steel Structures	
1.6	Advantages and Disadvantages of Steel Structures	
2.0	**Design of Steel Structures**	**3.5**
2.1	Method of Design	
2.2	Design Based on Allowable Structures	
2.3	Principles of Limit States Design of Steel Stresses	
2.4	Floor and Truss Systems	
2.5	Resistance to Horizontal Forces	
3.0	**Types of Joints**	**2**
3.1	Types of Rivetted Joints	
3.2	Types of Failures of Rivetted Joints	
3.3	Rivet Value and Efficiency	
3.4	Types and Stresses in Welded Joints	
4.0	**Design and Details of Joints**	**5**
4.1	Design of Rivetted Joints Under Axial Forces	
4.2	Design of Rivetted Joints Under Eccentric Forces	
4.3	Details of Rivetted Joints	
4.4	Design of Welded Joints Under Axial Forces	
4.5	Design of Welded Joints Under Eccentric Forces	
4.6	Details of Welded Joints	
5.0	**Design of Tension Members**	**1.5**
5.1	Types of Tension Members	
5.2	Net Sectional Area	
5.3	Design of Angles, Tee and Tubular Sections	
6.0	**Axially Loaded Compression Members**	**5**
6.1	End Conditions and Effective Lengths	
6.2	Radius of Gyration and Slenderness Ratio	
6.3	Strength of Compression Members	
6.4	Angle, Tubular and Built-Up Strut Members	
6.5	Design of Compressive Members	
6.6	Design of Lacings	

6.7 Design of Steel Battens
6.8 Design of Bases for Axially Loaded Columns

7.0 Eccentrically Loaded Compression Members **3**
7.1 Stress Calculations
7.2 Design of Members
7.3 Design of Column Splices
7.4 Design of Bases for Eccentrically loaded Columns

8.0 Design of Beams **6**
8.1 Beams Subject to Bending and Axial Forces
8.2 Bending and Axial Stress
8.3 Shear Stresses
8.4 Deflection Limitations
8.5 Design of Laterally Supported Beams
8.6 Design of Laterally Unsupported Beams
8.7 Web Crippling, Buckling and Stiffening
8.8 Design of Bearing Plates

9.0 Design of Composite and Built-Up Beams **2.5**
9.1 Difference between Composite and Built-Up Beams
9.2 Types of Built-Up Beams
9.3 Design of Cover Plates
9.4 Design of Rivets connecting Cover Plates with Flanges
9.5 Check of Stresses

10.0 Design of Plates Girders **3**
10.1 Elements of Plate Girder and Economical Depth
10.2 Design of Flanges, Including Curtailment
10.3 Design of Web Plates and Stiffeners
10.4 Design of Web Splices

11.0 Design of Roof Trusses **4**
11.1 Angular and Tubular Sections
11.2 Loads on Roof Trusses Forces and Deflection in Trusses
11.3 Forces and Deflections in Trusses
11.4 Design of Members for worst conditions
11.5 Design of Purlins
11.6 Design of Bearing and Anchorage
11.7 Design of Wind Bracings

12.0 Timber Structures **2**
12.1 Types and Properties of Timber
12.2 Allowable Stresses in Solid and Laminated Timber
12.3 Use of Timber as a Structural Member in Construction
12.4 Codes of Practice for Design of Timber Structures
12.5 Advantages and Disadvantages of Timber Structures

13.0 Design of Timber Structures **5**

13.1 Design of Compression Members
13.2 Design of Solid Rectangular Beams
13.3 Design of Laminated Beams
13.4 Check of Deflections
13.5 Types of Joints and Their Connections
13.6 Details of Joints

Tutorials:

There will be Four main assignments:

(a) Design and details of a continuous beams supported on columns
(b) Design and details of a main plate girder.
(c) Design and details of plane truss.
(d) Design and details of a main column, including base plate, foundation and anchorage.

Textbook:

1 "Design of Steel Structures", A. Arya and J.L. Ajamani, Roorkee, Nem Chand & Bros.

2 "Design of Steel Structures", L.S. Negi, New Delhi, Tata McGraw-Hill Publishing Co., 1989.

Reference:

1 "Steel Structures", V.N. Vazirani and M.H. Ratisoni, Delhi, Khana Publishers.

2 "Design of Steel Structures", Kazimi and Jindal, 2th Ed., Prentice Hall.

DESIGN OF REINFORCED CONCRETE STRUCTURES
EG 722 CE

Lecture : 4 **Year : 4**
Laboratory :3/2 **Part : A**
Tutorial : 3/2

		HOURS
1.0	**Concrete Structures and Design Concepts**	**6**
1.1	Limitations of Use of Plain Concrete	
1.2	Steel Reinforcement and the Concept of Reinforced Concrete	
1.3	Loads, Forces and Stresses	
2.0	**Working Stress Method**	**12**
2.1	Single Reinforced Sections	
2.2	Modular Ratio	
2.3	Neutral Axis Stress and Strain Diagrams	
2.4	Balanced, Over-reinforced and Under reinforced Sections	
3.0	**Reinforced Detailing**	**5**
3.1	Curtailment of Tensile Reinforcement	
3.2	Splices	
3.3	Spacing of Reinforcement and Concrete Cover	
3.4	Minimum and Maximum Reinforcement in Beams, Slabs, Columns, etc.	
3.5	Minimum and Maximum Sizes of Reinforcing Bars	
3.6	Details of Reinforcement in columns	
3.7	Bar Bending Schedule	
3.8	Details of Beam/Column Connections	
4.0	**Limit State Method of Design**	**12**
4.1	Safety and Serviceability Requirements	
4.2	Characteristic Strength of Materials and Partial Safety Factors	
4.3	Characteristic Loads and Their Partial Safety Factors	
4.4	Limit State of Collapse in Compression	
4.5	Limit State of Collapse in Shear	
4.6	Limit State of Collapse in Torsion	
4.7	Limit State of Serviceability in Deflection	
4.8	Limit State of Serviceability in Cracking	
5.0	**Design by the Limit State Method**	**15**
5.1	Singly Reinforced Concrete Continuous Beams	
5.2	Doubly Reinforced Concrete Continuous Beams	
5.3	One-way and two-way slabs	
5.4	Flanged Beams	
5.5	Axially and Eccentrically Loaded Columns	
5.6	Isolated Footing for Columns	
5.7	Combined Footings	
5.8	Staircases	

6.0 Introduction to Prestressed Concrete **10**

6.1 Materials used and their properties
6.2 Prestressing systems and Anchorages
6.3 Loss of Prestressing stress due to tendon Friction
6.4 Analysis and Design of Section in Flexure
6.5 Shear, Bond and Bearing Stresses
6.6 Cable layouts, Camber and Deflections
6.7 Introduction to the load Balancing concept

Laboratories:

Seven Laboratory exercises will be performed in this course. These are:

(a) Test a beam in pure bending failure.
(b) Test a beam in shear failure.
(c) Test a beam in combined bending and shear failure.
(d) Test a beam in bond/anchorage failure.
(e) Investigate the behaviour of a simply supported rectangular beam with single reinforcement. Record the deflection and strains for various loads and cracking patterns.
(f) Investigate the behaviour of rectangular beams with double reinforcement.
(g) Investigate the behaviour of reinforced concrete columns till failure.

Tutorials:

There will be five assignments that include submission of drawings. There are:

(a) Designing and detailing rectangular and flanged beams with single and double reinforcement.
(b) Designing and detailing one-way and two-way slabs.
(c) Designing and detailing axially and eccentrically loaded columns.
(d) Designing and detailing isolated and combined footings.
(e) Designing and detailing a staircase.

References:

"Design of Reinforced Concrete Structures", P. Dayaratnam, Oxford & IBH Publishing Company.

Textbook:

"Reinforced Concrete Limit State Design", A.K. Jain, 3rd Ed., Roorkee, Nem Chand Bros., 1989.

ADVANCED STRUCTURAL ANALYSIS AND DESIGN
(Elective)

Lecture : 3 **Year : 4**
Laboratory :3 **Part : B**
(Practical)

Any Two of the Following Topics would be jointly offered in this Elective Course. The detail will be worked out by the concerned instructors. The topics to choose from are:

(a) Bridge Engineering
(b) Matrix Analysis
(c) Structural Dynamics
(d) Plates and Shells
(e) Tall Buildings

COURSE IN MATERIALS

The courses in materials are intended to introduce the students to a wide range of materials that can be used in construction and maintenance of civil engineering projects. Some fundamentals of materials science are included in these courses. Emphasis in the courses is placed on the physical, mechanical and thermal properties of some important construction materials. This would help in selecting suitable materials for each particular project. Apart from providing sufficient information on the strength, stress/strain relationships, hardness, ductility, etc. of some fundamental materials, the effect of time and environment on the properties of these materials is also incorporated. This would allow adequate considerations and precautions during the design and construction phases.

Lectures are augmented by experiments in the laboratory for elaboration and verification of course material.

CIVIL ENGINEERING MATERIALS
EG 463 CE

Lecture : 3 **Year : 1**
Laboratory :1.5 **Part : B**

		HOURS
1.0	**Introduction**	**3**
1.1	Scope of the Subject	
1.2	Types of Building Materials	
1.3	Definition of Physical Properties of Materials	
1.4	Definition of Mechanical Properties of Materials	
1.5	Definition of Thermal Properties of Materials	
2.0	**Some Fundamentals of Materials Science and Behaviour**	**3**
2.1	Elements of Materials Science	
2.2	Review of Atomic Theory and Molecular	
3.0	**Materials Testing**	**3.5**
3.1	Stress/Strain Relationships, modulus of Elasticity and Poisson's Ratio	
3.2	Constituent Equations between stresses and strains	
3.3	Other mechanical models	
3.4	Effects of Repetitive and Dynamic Forces on Strength of Material	
4.0	**Metals**	**2**
4.1	Categorization of metals: Steel, Aluminium, cast Iron	
4.2	Steel Types	
4.3	Additives that provide different types of steel	
4.4	Processes used to provide different types of steel	
5.0	**Properties of Steel**	**7.5**
5.1	Physical Properties of Steel	
5.2	Microstructure Examination	
5.3	Elastic and Plastic Behaviour	
5.4	Ductility and Resilience of steel	
5.5	Hardness and Toughness of steel	
5.6	Other mechanical properties	
5.7	Deformation of steel	
5.8	Steel corrosion and treatment	
5.9	Thermal properties	
5.10	Fracture mechanics of steel	
6.0	**Properties of Wood**	**4.5**
6.1	Types of wood	
6.2	Laminated wood	
6.3	Strength Along and Perpendicular to the grain	
6.4	Physical properties	
6.5	Mechanical properties	

6.6 Thermal properties
6.7 Fracture mechanics of wood

7.0 Properties of Ceramic Materials **6.5**

7.1 Clay Testing
7.2 Deformation and strength of clay
7.3 Effect of water of clay
7.4 Physical tests on sand, aggregate and crushed rock
7.5 Physical and mechanical properties of brick
7.6 Physical and mechanical properties of tiles
7.7 Physical, mechanical and thermal properties of glass

8.0 Properties of Cementing Materials **6**

8.1 Lime and lime mortar testing
8.2 Chemical reaction between lime and water
8.3 Physical, mechanical and thermal properties of lime
8.4 Cement and cement mortar testing
8.5 Chemical reaction between cement and water
8.6 Physical, mechanical and thermal properties of cement mortar

9.0 Properties of Asphaltic Materials **6**

9.1 Types of Asphalt cements and tars
9.2 Asphalt testing
9.3 Mix design of Asphalt concrete
9.4 Physical, mechanical and thermal properties of asphalt concrete
9.5 Fracture mechanics of asphalt concrete
9.6 Asphalt shingles for roofs

10.0 Synthetic Polymers **4**

10.1 Definition
10.2 Basic types
10.3 Properties of some polymers
10.4 Use of Polymers in repairs of structures

Laboratories:

Seven Laboratory exercises will be performed in this course. These are:

(a) Microstructure examination of mild steel, alloy steel, aluminum alloy, cast iron and wood, using optical microscopes.
(b) Hardness (Rockwell) tests on mild steel, alloy steel, aluminum alloy and cast iron.
(c) Toughness (Charpy) tests on mild steel, alloy steel, aluminum alloy and cast iron.
(d) Tests to determine of linear coefficient of thermal expansion of aluminum, steel, wood, lime mortar, asphalt concrete and synthetic polymer.
(e) Sieve analysis of clay, sand, gravel and crushed rock.
(f) Microstructure examination of clay, lime mortar, cement mortar, asphalt concrete and on synthetic polymer.
(g) Abrasion, stability and flow tests on asphalt concrete specimens.

Textbook:

"Fundamentals of Engineering Materials", Peter A. Thornton and Vito J. Colangela, Prentice Hall Publishing Company, 1985.

CONCRETE TECHNOLOGY
EG 633 CE

Lecture : 2 **Year : 3**
Laboratory :1.5 **Part : A**

		HOURS
1.0	**Concrete Composition**	**2**
	1.1 Aggregates and their gradation	
	1.2 Sand and its gradation	
	1.3 Cement	
	1.4 Water	
	1.5 Admixtures	
2.0	**Aggregates and Sand**	**2**
	2.1 Types	
	2.2 Natural characteristics and their effects on concrete behaviour	
	2.3 Necessary properties	
	2.4 Crushing strength	
	2.5 Soundness	
	2.6 Abrasion strength	
3.0	**Portland Cement**	**3**
	3.1 Types, composition and microstructure	
	3.2 Physical properties and their effects on concrete behaviour	
	3.3 Chemical reaction when mixed with water	
	3.4 Microstructure of the Mix	
4.0	**Water**	**2**
	4.1 Quality of water for use in concrete	
	4.2 Water/cement ratio	
	4.3 Water as a curing agent for concrete	
5.0	**Concrete**	**3**
	5.1 Constituents and properties of concrete	
	5.2 Water cement ratio, workability, segregation and other properties of the fresh concrete	
	5.3 Grades and strength of concrete	
6.0	**Mix Design of Portland Cement Concrete**	**3**
	6.1 Mix proportioning (Dept. of Environment method and ACI Method)	
	6.2 Choice of cement type in the mix	
	6.3 Density and air content	
	6.4 Physical properties	
	6.5 Use of air-entraining agents	
	6.6 Use of additives	
7.0	**Concrete Strength**	**4**

7.1 Cube and cylinder compressive strength after 1,7,28 and 90 days
7.2 Effect of time and temperature on strength
7.3 Indirect tensile strength
7.4 Direct tensile strength
7.5 Flexural tensile strength
7.6 Share strength
7.7 Bearing and bond strength
7.8 Effect of repetitive and dynamic loads on strength

8.0 Properties of Concrete **4**

8.1 Static stress/strain relationships
8.2 Elastic and plastic properties of concrete
8.3 Modulus of elasticity and poisson's ratio
8.4 Durability of portland cement concrete
8.5 Creep and shrinkage deformations
8.6 Importance of concrete curing
8.7 Effect of water/cement ratio on concrete performance

9.0 Quality Assessment and Control **3**

9.1 Slump tests to check workability
9.2 Control of water/cement ratio
9.3 Prevention of segregation and bleeding of concrete
9.4 Samples for checking strength
9.5 Properties against adverse weather conditions

10.0 Use of Concrete in Reinforced Concrete Structures **4**

10.1 Modular ratio of steel and concrete
10.2 Bond between steel and concrete
10.3 Corrosion of steel in reinforced concrete structures
10.4 Reasons for corrosion
10.5 Preventive measures against corrosion

Laboratories:

Six Laboratory exercises will be performed in this course. These are:

(a) Tests to determine crushing and abrasion strength of different types of aggregates.
(b) Mix design of cement concrete using different types and amounts of cement.
(c) Compressive strength tests on concrete cubes and prisms having variable mixes and water/cement ratio.
(d) Indirect and direct tensile strength tests on concrete cylinders having variable mixes and water/cement ratios.
(e) Flexural tensile strength tests on concrete beam loaded a third points and having variable mixes and water/cement ratios.
(f) Measuring shrinkage deformations of concrete prisms having variable mixes and water/cement ratios.

Textbook:

"Properties of Concrete", A.M. Neville, Pitman Publishing Ltd., 3rd Edition, 1981.

COURSES
IN
SOIL MECHANICS AND TRANSPORTATION ENGINEERING

A. Course in Engineering Geology

In this course, the students learn how to identify the different types of rocks, rock structures and weathering grades. They are also taught geological maps and how to draw dips, strikes, out-crop, stratum contour, fault and fold in maps.

Furthermore, the course helps students to know about the geological structures of Nepal for building structures, dams, roads, tunnels, canals and bridges. Information about rock-fall, crosion, slope stability and ground water development is also provided.

B. Course in Soil Mechanics

This course is aimed at teaching the students the concepts of soil engineering, including the science and technology of soils and their application to problems in Civil engineering.

The course emphasizes the fundamentals and relevant principles of soil mechanics, gives an overall picture of the bahaviour of soils and describes the nature of some of the soil problems encountered in Civil engineering.

C. Courses in Foundation and Geotechnical Engineering

The objective of these course is to provide the student with the basis concepts and tools that can be used to determine the structure/foundation/soil interactions. The courses include a review of soil mechanics principles and deal with a variety of foundations and retaining walls. They also cover design of foundations for static and dynamic loads.

D. Courses in Transportation Engineering

The first course is aimed at providing the student with a general background on the various modes of transportation, with special emphasis on highways, their various classes, drainage and materials properties.

The second course deals with traffic analysis and design of highway intersections. The course material also cover the design of flexible and rigid pavements, construction practices and maintenance procedures. Furthermore, component parts of highways, such as lighting, bridges and tunnels, are discussed in the course.

The third course, with is elective, is a transportation planning and engineering courses. The main objectives of this course is to teach the students how to develop and apply models to simulate the urban and regional movement of people and goods so that adequate transportation can be provided to accommodate these movements. The course provides also and introduction to railway and airport engineering.

ENGINEERING GEOLOGY
EG 523 CE

Lecture : 4 **Year : 2**
Laboratory :2 **Part : A**

		HOURS
1.0	**Introduction**	**3**
1.1	Scope of geology in civil engineering	
1.2	Basic review of earth sciences	
1.3	The earth: Its structure and environment	
1.4	Various Landforms on the surface of the earth: mountains, plateaus, shields	
2.0	**Changes in the Faces and Structure of the Earth**	**4**
2.1	Plate tectonics	
2.2	Seismicity	
2.3	Cause and effects of earthquakes	
2.4	Volcanism	
2.5	Fold mountains	
3.0	**Geology in Civil Engineering**	**4**
3.1	Definition of engineering geology	
3.2	Different branches of geology	
3.3	Scope and objective of engineering geology	
3.4	Importance of engineering geological studies in Nepal	
3.5	Relationships between geology and earth sciences	
4.0	**Crystallography and Mineralogy**	**6**
4.1	Arrangement of atoms in crystals, crystal forms and habits, and crystal classes	
4.2	Definition of minerals	
4.3	Physical properties of minerals: habits, cleavage, hardness (Moh's hardness scale) and specific gravity	
4.4	Other properties for classification and identification of minerals	
5.0	**Rock Forming Minerals**	**3**
5.1	Importance rock forming minerals and their engineering significance	
5.2	Quartz, Feldspars, Mica, chloride, Epidote, Honblends, Pyrozene, Olivine, Serpentine and Pyrites	
5.3	Other Rock forming minerals: calcite, dolomite, opal, limonite, gypsum, clays, barytes, bauxite	
6.0	**Petrology**	**7**
6.1	Definition	
6.2	Petrographic classification: Igneous, sedimentary and metamorphic rocks	
6.3	Engineering significance of the three rock classes	
6.4	Macroscopic study of the basic physical and engineering properties of rocks	
6.5	Study of igneous rocks: granite, Rhyolite, gabbro and basalt	

6.6 Study if sedimentary rocks: clay, shale, limestone, dolomite, sandstone and conglomerate
6.7 Study of the Metamorphic rocks: slate, phyllite, schist, gneiss, marble, quartzite

7.0 Structural Geology **8**

7.1 Rock deformation and reasons
7.2 Study of folds, faults and joints cleavage
7.3 Introduction to dip, strike and outcrop
7.4 Unconformity
7.5 Orientation of geological strata using geological maps, plans and cross-sections
7.6 Planes of discontinuities in rock masses
7.7 Engineering classification of rock masses

8.0 Mass Movement and Rock Slope Engineering **6**

8.1 Types of landslides and factors affecting slope stability
8.2 Preventive measure for landslides and corrective methods for maintaining stability
8.3 Rock fall, rock slide and mud flow

9.0 Hydrogeology **5**

9.1 Morphology of river channel, transportation and disposition
9.2 Groundwater movement and its origin
9.3 Permeability and porosity
9.4 Aquifer, aquiclude, water level and piezometric levels
9.5 Confined and unconfined aquifers
9.6 Springs and reservoirs

10.0 Site Investigation **8**

10.1 Interpretation of Topographic Maps
10.2 Aerial Photographs and geological maps
10.3 Geophysics and use of engineering geological maps for terrain evaluation
10.4 Site exploration: drilling, test methods and borehole logs
10.5 Geological investigations for dams and reservoirs, roads and pavements, foundations, bridges and tunnels

11.0 Engineering Geology of Nepal **6**

11.1 Geological division of Nepal
11.2 Distribution of different rock/soil types
11.3 Geological structures and their engineering significance

Laboratories:

Six Laboratory exercises will be performed in this course, in addition to two site visits and one 3-day field trip. These are:

(a) Identification of rocks and minerals.
(b) Study of rock structures.
(c) Study of effects of weathering and outcrop.

(d) Study of topographic maps, preparation of profiles, interpretation of geologic maps and aerial photographs, construction of geological cross-sections and stratum contours.
(e) Preparation of interpretative engineering geological maps.
(f) Study of fault and fold maps, borehole and three point problems.

Textbook:

1 "Principles of Physical Geology", Sanders, John Wiles and Sons, New York.

2 "Principles of Physical Geology", A. Homes, ELBS English Language Society.

3 "Principles of Structural Geology", M.P. Billings, Prentice Hall of India, New Delhi.

4 "Geology of Nepal", Dr. C.K. Sharma, Educational Enterprises.

SOIL MECHANICS
EG 623 CE

Lecture : 4 **Year : 3**
Laboratory :2 **Part : A**

		HOURS
1.0	**Introduction**	**2**
1.1	Importance of soil mechanics and soil problems in civil engineering	
1.2	Historical development of soil mechanics	
1.3	General approach of solving soil mechanics problems	
2.0	**Physical and Index Properties of Soils**	**6**
2.1	Soil as a three-phase materials	
2.2	Basic definitions of phase relationships	
2.3	Index properties of soil	
2.4	Determination of various index properties	
3.0	**Soil Identification and Classification**	**6**
3.1	Field Identification of soils	
3.2	Soil Classification: Descriptive, Textural, ISI, MIT and Unified	
3.3	Practical implications of the soil classification systems	
4.0	**Soil Compaction**	**4**
4.1	Compaction process and compaction theories	
4.2	Moisture-density relationship and degree of compaction	
4.3	Laboratory determination of compaction characteristics	
4.4	Field compaction and compaction control	
4.5	Effects of compaction on engineering behaviour of soils	
5.0	**Soil-water Interaction**	**6**
5.1	Mode of occurrence of water in soils	
5.2	Surface tension and the capillary phenomenon	
5.3	Flow of water through the soil mass	
5.4	Permeability of soils	
5.5	Determination of the coefficient of permeability: laboratory and field methods	
5.6	Pumping tests through confined and unconfined aquifers	
5.7	Effects of water on swelling and shrinkage of soils	
6.0	**Principles of Effective Stress**	**4**
6.1	Stresses in subsoil	
6.2	Effective stress principle	
6.3	Physical interpretation of effective stress equations	
6.4	Computation of effective stress for the static and flow conditions	
6.5	Quick sand phenomenon and remedial measures	
7.0	**Seepage Analysis**	**6**
7.1	Two dimensional fluid flow	

7.2 Conditions for continuity of flow
7.3 Laplace's equation, flow nets and their principles
7.4 Boundary conditions
7.5 Flow nets and their application
7.6 Laplace's equation for an Isotropic soil and its application
7.7 Deflection of flow lines at the interface of two different soils
7.8 Phreatic line in an earth dam
7.9 Design of filter

8.0 Stress Distribution of Soils **6**

8.1 State of stress at a point in the subsoil
8.2 Stress from elastic theories
8.3 Boussinesq's theory of stress distribution
8.4 Extension of Boussinesq's analysis to uniformly loaded areas
8.5 Use of Newmark's charts and other tables and charts in computing stresses
8.6 Effects of layer systems on stress distribution
8.7 Elastic settlement and contact pressure

9.0 Shear Strength of Soils **7**

9.1 Concept of shear strength
9.2 Principal planes and principal stresses
9.3 Mohr-Coulomb theory of shear strength
9.4 Mohr's stress circle and failure envelop
9.5 Relation between principal stresses at failure
9.6 Types of shear tests
9.7 Measurement of shear strength in the laboratory
9.8 Vane shear test
9.9 Shear strength of sands
9.10 Shear strength of saturated and unsaturated clays

10.0 Consolidation and Settlement **7**

10.1 Behaviour of soil under compressive loads
10.2 Settlement of Structures resting on soil: its nature, causes and remedial measures
10.3 The consolidation process and Terzaghi's spring Analogy.
10.4 Primary and secondary consolidation
10.5 Consolidation test
10.6 Compressibility of soil
10.7 Normally consolidated (NC) clays, over consolidated (OC) clays and preconsolidation pressure
10.8 Determination of field pressure-void curve
10.9 Estimation of consolidation settlement
10.10 Rate and degree of consolidation
10.11 Terzaghi's theory of one dimensional consolidation
10.12 Determination of coefficient of consolidation
10.13 Estimation of rate and magnitude of settlement

11.0 Stability of Slopes **6**

11.1 Causes of slope movements and failures

11.2 Types of slope and slope failures
11.3 Critical surfaces and factor of safety
11.4 Method of stability analysis and stability number
11.5 Stability Analysis of Infinite slopes
11.6 Stability Analysis of finite slopes
11.7 Methods of slices
11.8 Remedial measures for slope stability problems

Laboratories:

Eight Laboratory exercises will be performed in this course, in addition to one day field trip. These are:

(a) Sieve analysis of coarse and fine aggregates.
(b) Determination of Atterberg limit of soil.
(c) Use of in-situ density core cutter and the method of sand replacement.
(d) Determination of optimum moisture content and maximum dry density.
(e) Unconfined compression test
(f) Direct shear test.
(g) Constant head permeability test.
(h) UU triaxial test.

Textbook:

1 "A Text Book of Soil Mechanics", Dr. Sehgal, S.B., CBS Publishers and Distributors, New Delhi, 1988.

2 "Soil Mechanics in Engineering Practice", Terzaghi, K. and Peck, R.B., John Wiley, 2nd Edition, New York, 1967.

3 "Physical and Geological Properties of Soils", Joseph E. Bowles, McGraw Hill Co., Ltd., 2nd Edition, 1984.

FOUNDATION ENGINEERING
EG 663 CE

Lecture : 4 **Year : 3**
Laboratory :2 **Part : B**
(Practical)

		HOURS
1.0	**Introduction**	**2**
1.1	Soil/foundation interaction	
1.2	Function of foundation and its types	
1.3	Factors influencing the choice of a foundation	
2.0	**Site Investigation**	**7**
2.1	Objectives, stages and methods of site investigation	
2.2	Sampling of soils, samplers, sample area	
2.3	Field measurement of consistency and relative density	
2.4	Plate loads test and In-situ permeability test	
2.5	Ground water observation	
2.6	Bore Hole logs	
2.7	Preservation, transportation and storage of samples	
2.8	Laboratory tests on soils	
2.9	Preparation of site investigation reports	
3.0	**Earth Pressure and Retaining Structures**	**13**
3.1	Types of earth pressure	
3.2	Steady state equilibrium and earth pressure at	
3.3	Elastic and plastic equilibrium	
3.4	Concept of stress path	
3.5	Stress path for rankine active and passive conditions	
3.6	Modified failure envelope of line	
3.7	Rankine state of plastic equilibrium	
3.8	Strains associated with rankine's states	
3.9	Local state of plastic equilibrium, deformation and boundary conditions	
3.10	Rankine's earth pressure Theory	
3.11	Action earth pressure on cohesionless backfill	
3.12	Active and passive earth pressure on backfill	
3.13	Active thrust by trial wedges and limitations of the method	
3.14	Influence of wall friction	
3.15	Coulomb's earth pressure theory and its graphical solution	
3.16	Limitations of Coulomb's wedge theory	
3.17	Selection of soil parameters for earth pressure computations	
3.18	Stability analysis of an earth retaining structure	
4.0	**Bearing Capacity and Settlement of Shallow Foundations**	**8**
4.1	Types of failures	
4.2	Types of bearing capacity, and factors influencing	
4.3	Ranker, Ranking and Bells theories	

4.4 Modes of foundation failure
4.5 Prandit's theory
4.6 Terzaghi's general bearing capacity theory
4.7 Extension of Terzaghi's theory
4.8 Introduction to recent bearing capacity theories
4.9 Ultimate bearing capacity of conhesionless and cohesive soils
4.10 Effects of various factors on bearing capacity
4.11 Types of settlement and relationship
4.12 Limitations of the methods for predicting settlement
4.13 Bearing capacity from In-situ tests

5.0 Design of Spread Foundation **4**

5.1 Common types of spread footings and their use
5.2 Depth of footings
5.3 Design Procedure
5.4 Bearing capacity and settlement of spread footings
5.5 Permissible settlement
5.6 Proportioning of spread footings for uniform settlement
5.7 Stresses on lower strata
5.8 Design of spread footings on firm soil above soft layers
5.9 Construction of spread footing

6.0 Mat Foundations **4**

6.1 Types of mat foundation and their use
6.2 Bearing capacity and settlement of mat foundation
6.3 Design of mat foundation in sand and clay
6.4 Construction of mat foundations

7.0 Pile Foundation **8**

7.1 Types of piles, advantages and disadvantages
7.2 Classification of piles and their selection
7.3 Soil - pile interaction
7.4 Carrying capacity of piles in clay and sands
7.5 Pile driving forlumae
7.6 Group action of pile
7.7 Bearing capacity and settlement of pile groups
7.8 Negative skin friction
7.9 Piles resisting uplift
7.10 Piles resistance under the action of inclined loading
7.11 Pile load tests
7.12 Construction of pile foundation
7.13 Damage, alignment and effect of pile driving

8.0 Pier Foundation **3**

8.1 Function of piers and their types
8.2 Bearing capacity and settlement of piers
8.3 Skin friction on pier shafts
8.4 Design of piers in sand and clay
8.5 Construction of pier foundations

9.0 Well or Caisson Foundation **3**

9.1 Use of caisson foundation and their types
9.2 Bearing capacity of caissons in sand and clay
9.3 Design of caissons
9.4 Sinking of caissons

10.0 Sheet Piles and Coffer Dams **5**

10.1 Common types of sheet piles and their uses
10.2 Classification of sheet piled walls
10.3 Design of Contilever and Anchored sheet piled walls
10.4 Construction of sheet piled walls
10.5 Common types of coffer dams and their uses
10.6 Design of braced coffer dams
10.7 Construction of braced coffer dams

11.0 Geotechincal Processes **3**

11.1 Ground water in excavation and methods of its control
11.2 Foundation stabilization and underprinning

TRANSPORTATION ENGINEERING I
EG 673 CE

Lecture : 4 **Year : 3**
Laboratory :2/2 **Part : B**
Tutorial : 1

HOURS

1.0 Introduction to Transportation Planning and Engineering 6

1.1 Modes of transportation: Highways, Railways, Airways and waterways
1.2 Comparison between various modes of transportation and constraint on their development in Nepal
1.3 Approach to road planning: establishing economic and environmental viability, evaluating alternatives, people's participation in planning and decision making
1.4 Historical development of roads and road construction in Nepal
1.5 Classification of roads: based on volume and based on locations
1.6 National road network, city or local networks, and ring roads

2.0 Highway Surveys 4

2.1 Process of identifying best route location
2.2 Physical surveys: map study and reconnaissance, preliminary and detailed surveys
2.3 Highway alignment and controlling factors

3.0 Geometric Design of Highways 20

3.1 Definition and scope of geometric design
3.2 Basic design control and criteria: design speed, design vehicle, traffic volume and its composition, topography, etc.
3.3 Highway lanes, their width and calculation of their numbers
3.4 Other elements of the highway cross-section
3.5 Elements of horizontal alignment: Tangents, Circular curves and transition curves
3.6 Design of horizontal alignment and superelevation
3.7 Horizontal sight distance based on stopping and on passing
3.8 Elements of vertical alignment: Tangent vertical curves and gradient
3.9 Design of vertical alignment: vertical curve over crest and in sag
3.10 Recommendations for alignment designs and coordination of horizontal and vertical alignments

4.0 Hill Roads 8

4.1 Special considerations in hill road design: speed, barometric pressure, temperature, rainfall, geological conditions and alignment selection
4.2 Gradient selection for High altitude roads
4.3 Typical cross-sections and detailing of hill roads
4.4 Design of hairpin bends
4.5 Special structures in hill roads: retaining and slope protection structures, and drainage structures

4.6 Stability of formation and cut slopes (Rocky slope, soil slope)
4.7 Passing lanes in hill roads

5.0 Highway Drainage 10

5.1 Importance of highway drainage
5.2 Surface drainage and estimation of water quantities
5.3 Classification of highway drainage structures and design of drainage components
5.4 Erosion control and energy dissipating structures
5.5 Other miscellaneous cross drainage structures
5.6 Subsurface drainage: drainage of infiltrated water, control of seepage flow, and lowering water table
5.7 Subsurface drain: diameter of pile and its performances, slope of pile, manholes etc.

6.0 Highway Materials 12

6.1 Classification of materials: mineral materials, binding materials and materials for general construction purposes
6.2 Types of aggregated and tests on their gradation, strength, durability etc.
6.3 Mathematical and graphical methods of aggregate gradation
6.4 Binding materials and their classification: natural bitumen, petroleum bitumen, penetration emulsions, road tar, etc.
6.5 Tests on binders: Consistency test, composition test etc.
6.6 Bitumenous mixers and asphalt concrete: open graded mixes and dense graded mixers
6.7 Design of bitumenous mixers and optimum binder content.

Laboratories:

Five Laboratory exercises will be performed in this course, in addition to field trip. These are:

(a) Abrasion value of crushing value or ten percent fines value
(b) Penetration value or viscosity value or softening point or ductility value of bitumen
(c) Skid resistance test on road surface
(d) Marshall stability test and asphalt mix design
(e) Analysis of bituminous mixture by the funnel and sieving extractor methods

Tutorial: Six assignments

Textbook:

1 "Transportation Engineering" V.N. Vazirani and S.P. Chandola, Khanna Publishers, New Delhi.

2 "Highway Engineering", N.K. Vaswami, Roorkee Publishing House.

TRANSPORTATION ENGINEERING II
EG 723 CE

Lecture : 4 **Year : 4**
Laboratory :2/2 **Part : B**
Tutorial : 1

HOURS

1.0 Traffic Engineering **4**

1.1 Introduction to traffic engineering and its scope
Interrelationships between human/machinery/environmental elements
1.3 Impact of human and vehicular characteristics on traffic planning
1.4 Traffic operations and regulations covering driver control and vehicle control
1.5 Traffic control devices: Signs, signals, road making and traffic islands

2.0 Traffic Studies **6**

2.1 Traffic flow counts and speed studies
2.2 Traffic flow characteristics studies
2.3 Origin and destination studies
2.4 Parking studies and design of parking facilities
2.5 Accident study and Analysis

3.0 Road Intersections **8**

3.1 Basic requirements of intersections
3.2 Types of intersections and their configuration
3.3 Channelized and Unchannelized intersections
3.4 Warrants for signalization and choice of traffic control devices
3.5 Design of intersection approaches for one-way and two-way streets
3.6 Design of intersections for rural roads

4.0 Road Lighting **2**

4.1 Importance of road lighting
4.2 Factors influencing night visibility
4.3 Requirements of level of illumination in roads
4.4 Design of the lighting system: selection of height of lamps, spacing between light poles, height and overhang of light poles, lateral placement, etc.

5.0 Road Pavement **15**

5.1 Definition and types of pavements
5.2 Differences between flexible and rigid pavement structures
5.3 Loads and other factors controlling pavement
5.4 Design methods for flexible pavements
5.5 Details of the asphalt institute method of design of flexible pavements
5.6 Design methods for rigid pavements and Westergaard's theory
5.7 Stresses due to load, temperature differential and subgrade friction
5.8 Details of the IRC method of design of rigid pavements for highways

6.0 Road Construction Technology **10**

6.1 Activities and techniques used in road construction
6.2 Tools, equipment and plants used in road construction
6.3 Preparation of road bed: excavation, fill, compaction, soil stabilization, etc.
6.4 Construction of asphalt concrete layers, including prime coats, tack coats and seal coats
6.5 Construction procedure of grouted or penetration macadam
6.6 Construction procedure of bituminous bound Macadam
6.7 Construction procedure of plain concrete pavements

7.0 Highway Maintenance, Repair and Rehabilitation 15

7.1 Classification of maintenance activities for road pavement and road facilities
7.2 Inspection, prioritization and planning of maintenance operations
7.3 Evaluation of pavement distress and pavement condition
7.4 Types and methods of pavement repair
7.5 Types of overlays and strengthening of existing pavements

8.0 Introduction to Bridge and Tunnel Engineering 5

8.1 Choice of location of bridge site
8.2 Classification of bridges and component parts of a bridge
8.3 Hydraulic analysis of bridges
8.4 River bank and protection structures
8.5 Types of roads and railway tunnels
8.6 Component parts of tunnels and tunnel cross-section
8.7 Survey for tunnel alignment
8.8 Drainage, lighting and ventilation requirements for tunnels
8.9 Methods of tunnelling in firm, soft and rock soils
8.10 Tunnel lining

Laboratories:

A practical assignment on highway and pavement design that include data collection, will be undertaken in this course. The following studies will be conducted:

(a) Determination of CBR in the laboratory.
(b) Measurement of spot speed and data analysis.
(c) Measurement of deflection of pavement surface.

Tutorial: Four assignments

Textbook:

1 "A Test-book on Highway Engineering and Airports", S.B. Sehgal and K.I. Bhanot, S. Chand and Co. Publishers Ltd., Delhi

2 "Principles, Practice and Design of Highway Engineering", S.K. Sharma, S. Chand and Co. Ltd., New Delhi.

ADVANCED GEOTECHNICAL AND FOUNDATION ENGINEERING II
(Elective)

Lecture : 3.5 **Year : 4**
Laboratory :2 **Part : B**

HOURS

1.0 Dynamically Loaded Foundations **6**

1.1 Selection of design criteria
1.2 Identification of dynamic Loads
1.3 Design of foundations subjected to dynamic loaded (machine foundations, etc.) : spring-supported model, analysis of foundation vibration on elastic layers, effect of foundation shape and embedment
1.4 Vibration transmission, isolation and monitoring

2.0 Foundations in Earthquake Regions **7**

2.1 Selections of design earthquake
2.2 Site response to earthquake: site specific conditions soil structure interaction and their influence on ground motions, response spectra
2.3 Seismic analysis: selection of response spectrum corresponding to the design earthquake, determination of seismic loads
2.4 Design of foundations for earthquake conditions: earth retaining structures, footing foundations, mat foundations, etc.

3.0 Design of Tunnels **12**

3.1 General design considerations: geological studies and investigations, selection of tunnel alignment
3.2 Analysis of loads on tunnels: types of rock pressures, stress around underground excavations/tunnels, vertical rock pressure, lateral rock pressure, bottom pressure, development of rock pressure during excavation
3.3 Design of tunnel sections: determination of design loads, determination of optional types of tunnel cross sections (horseshoe, circular, elliptical and rectangular cross-sections) assuming the sector to consist of individual segments as well as one composite/monolithic ring, design of circular pressure tunnels

4.0 Field Instrumentation and Monitoring **11**

4.1 Types of field measurement and their uses
4.2 Monitoring displacements of foundations and structures: vertical displacements and horizontal displacements
4.3 Monitoring slope/rockmass movement: slope movement using borehole extensometers, Inclinometers and Tiltmeters; rockmass displacement in underground excavations etc. Using optical electro-optical methods of borehole extensometers
4.4 Monitoring pressures/loads in earth: walls and structures; monitoring pressures in the body of earth structures; monitoring loads on temporary supports
4.5 Monitoring In-situ stresses in rock: hydraulic fracture techniques, direct stress measurement techniques, and borehole methods

4.6 Monitoring pore pressure: methods based on various types of piezometers, selection of piezometers to suit the ground conditions
4.7 Recording and data handling

5.0 Geosynthetics 9

5.1 Types of geosynthetics
5.2 Application of geosynthetics drainage, filtration reinforcement and separation
5.3 Design considerations: physical properties, mechanical/hydraulic/durability requirements
5.4 Construction requirements: site preparation, selection of equipment, placement and compaction requirements

6.0 Anchors, Rock Bolts and Shotcrete 9

6.1 Application and types of anchors and rock bolts
6.2 Design criteria: safety against uplift, overturning, tangential displacement, shear failure and caving in
6.3 Installation: drilling, insertion, grouting (anchoring) stressing and final grouting
6.4 Mechanism of load transfer in anchors
6.5 Testing of anchors
6.6 Protection from corrosion
6.7 Selection of materials and mix design of shotcrete
6.8 Engineering properties of shotcrete
6.9 Placement of shotcrete

7.0 Grouting 4

7.1 Purpose of grouting
7.2 Classification of grouting materials
7.3 Characteristics of good routing materials: viscosity, setting time, permeability of grouting works
7.4 Planning of grouting works
7.5 Selection of grouting materials
7.6 Grouting methods
7.7 Control of grouting works

Tutorial: Three assignments that would include computer application.

Textbook:

"Principles of Geotechnical Engineering", B.M. Das, Boston PWS Engineering, 1985.

Further Reference:

1 "Engineering Principles of Ground Modifications", M.R. Housmann, McGraw-Hill Co., 1990, New York.

2 "Grouting in Engineering Practice", R. Bowen, Allied Science Pub., London, 1981

3 "Underground Excavation", E. Hoek & E. Brown, Institution of Mining & Metallurgy, London, 1980

4 "The Art of Tunnelling", K. Szechy, Akademiai Budapest, 1966.

5 "Foundation in Tension", T.H. Hanna, Trans. Tech. & McGraw-Hill Book Co., 1982.

6 "Foundation Instrumentation", T.H. Hanna, Trans. Tech. & McGraw Hill Book Co., 1973.

ROCK MECHANICS

(Elective)

Lecture: 4 **Year: 4**
Tutorial: 1 **Part: B**

1. Fields of Application of Rock Mechanics **2**

2. Nature of Rocks **2**

3. Classification and Index Properties of Rocks: **5**

3.1. Geological classification
3.2. Index properties of rock system
3.3. Porosity
3.4. Density
3.5. Permeability
3.6. Strength
3.7. Slaking and durability
3.8. Sonic velocity as an index to degree of fissuring

4. Classification of Rock Mechanics for Engineering Purposes **7**

5. Rock Strength and Failure Criteria **7**

5.1. Modes of Failure of Rock
5.2. Common lab strength tests
5.3. σ - ε behaviour in compression
- σ-ε
- Hydraulic compression.
- Deviatoric compression
- Effect of $\sigma 3$

5.4. Meaning of rock strength
5.5. σ-ε curve
5.6. Mohr-coulomb failure criteria
5.7. Effect of water
5.8. Empirical failure criteria
5.9. Effect of size on strength
5.10. Anisotropic rocks.

6. Initial Stresses in Rocks and their Measurement **7**

6.1. Influence of the initial stresses
6.2. Estimating the initial stresses
- Vertical stresses
- Horizontal stresses
- Horizontal stresses direction

6.3. Techniques for measurement of In-situ stress
- Hydraulic fracturing
- Flat jack method
- Overcoring

7. Planes of Weaknesses in Rock 5

7.1 Joint orientations
7.2 Joint testing
7.3 Joint Roughness
7.4 Effect of water pressure

8 Deformability of Rocks 7

8.1 Elastic and nonelastic behaviour
8.2 Elastic constants
8.3 Measurement of deformability properties by static tests
- Lab compression test
- Plate bearing test
- Borehole and gallery test
- Radial jacking test
- Flat jack test
- Dynamic measurement
- Fractured rocks

9.0 Influence of Time on Rock Deformation 6

9.1 Viscous behaviour and creep
9.2 Linear viscoelastic models
9.3 Determining visco – elastic constants from lab tests
9.4 Determining visco – elastic constants from lab field tests
9.5 Tertiary of stress rate

10.0 Application of Rock Mechanics to Rock Slope Engineering 7

10.1 Modes of failure of slope in hard rock
10.2 Kinematic analysis of slopes
10.3 Analysis of plane
10.4 Analysis of plane sliding of the stereographic projection
10.5 Analysis of wedge sliding using stereographic projection
10.6 Analysis of slides composed of two blocks.

11.0 Openings in Competent Rock 5

11.1 Horizontally layered rock
11.2 Rock with inclined layers
11.3 Plastic behaviour around tunnels
11.4 Time dependent behaviour of tunnels
- A lined circular tunnel in a hydrostatic stress field.

TRANSPORTATION PLANNING AND ENGINEERING

(Elective)

Lecture : 4 **Year : 4**
Laboratory :2 **Part : B**
(Practical)

HOURS

1.0 Introduction **8**

1.1 Scope of transportation panning and transportation system engineering
1.2 Organizational structure of Ministry of Works & Transport and its departments
1.3 The decision making and process in transportation for planning, design, implementation, monitoring and development of transportation facilities
1.4 Model characteristics and roles
1.5 Simulation techniques and the scientific approach to model development
1.6 Transportation networks: their characteristics and their analysis

2.0 Urban and Regional Transportation Planning **12**

2.1 Differences between urban and regional planning
2.2 Differences in planning for movement of people and goods
2.3 Hierarchical structure to transportation planning: intermodal approach and integrated development approach
2.4 Transport demand surveys and studies: survey design and field studies, data requirements for passenger and freight movements
2.5 Predicting future demand

3.0 The Urban Transportation Planning Process **14**

3.1 The conventional approach: gravity model
3.2 Planning phases: trip generation, trip distribution, model split and traffic assignment
3.3 The supply side of transportation: the modes, their roles and characteristics (capacity, cost, etc.)
3.4 Other recent approaches to transportation planning

4.0 Transportation Systems Analysis **4**

4.1 Generation of alternatives
4.2 Evaluation of alternatives and criteria used
4.3 Selection considerations: capital and operating expenditures, etc.

5.0 Introduction to Airport Engineering **9**

5.1 Airport classification: international, domestic, general aviation, military
5.2 Aircraft types: jet, propeller number of engines, etc.
5.3 Predicting air travel demand
5.4 Selection of airport site
5.5 Layout of the airfields and their geometric standards
5.6 Terminal facilities and their space requirements
5.7 Introduction to the design of airfield pavements

6.0 Introduction to Railway Engineering **9**

6.1 Classification of railways
6.2 Components of the railways section
6.3 Geometric design of the railway track
6.4 Design of the track structure
6.5 Railway switches and crossings
6.6 Railway side tracks and yards

7.0 Transportation System in Nepal 4

7.1 Overview of the existing system and future trend
7.2 Constraints on the development of railway system in Nepal
7.3 Government policy, legislation and jurisdiction
7.4 Planning of grouting works
7.5 Selection of grouting materials
7.6 Existing planning processes

Laboratories:

Five practical assignment will be performed in this course. These are :

(a) Design of a survey questionnaire for a small urban transportation planning project.
(b) Collection of data for the survey.
(c) Use of data as input for the transportation planning process, and apply a computer program to obtain outputs.
(d) Design and draw the airfields for a small airport project.
(e) A railway assignment.

Textbook:

1 "Principles of Urban Transport Planning", B.C. Hutchinson, McGraw Hill Publishing Company.

2 "Introduction to Transportation Engineering and Planning", E.K. Morlok, International Student Edition, McGraw Hill Publishing Company, 1987.

3 "Transportation Engineering", Volume I and II, V.N. Vazirani and S.P. Chandola, Khanna Publishers, Delhi, India.

COURSES IN SURVEYING

The main objective of these courses is to provide the students with the basic knowledge of different surveying techniques relevant to the civil engineering field.

Fundamental theories and methods of surveying are taught first. After that, emphasis is placed on surveying techniques that are important to civil engineering. Advanced methods are covered in an elective course that deals with astronomy and photogrammetry. These are needed in frequent situations in the engineering field.

After successful completion of the surveying courses and a two-week work in the field, the students are expected to be able to perform surveying work needed in actual civil engineering projects.

SURVEYING I
EG 525 CE

Lecture : 3 **Year : 2**
Laboratory :3 **Part : A**
Tutorial : 1

HOURS

1.0 Introduction **2**

1.1 Historical background to the development of surveying
1.2 Modern disciplines of surveying and their significance
1.3 Disciplines of surveying significant to civil engineering

2.0 Linear Measurements **5**

2.1 Units of measurements
2.2 Linear measurement techniques
2.3 Chain, tape, ranging rods and arrows
2.4 Station marks
2.5 Representation of measurement and need of scales
2.6 Common scales
2.7 Sources of error in linear measurements - commonly accepted error ratios
2.8 Effects of slopes and slope corrections
2.9 Corrections for chain and tape measurements
2.10 Uses of abney level and clinometer
2.11 Instruction on field work

3.0 Chain Survey **6**

3.1 Basic principles and geometry of area measurement - base line, tie line and check line
3.2 Importance of survey stations and practices of marking them
3.3 Detailing procedures - offsets
3.4 Field work booking methods
3.5 Errors and their effects
3.6 Possible obstacles and methods of overcoming them
3.7 Method of plotting and conventional symbols
3.8 Instruction on field applications

4.0 Compass Survey **6**

4.1 Concept of reference direction - meridians
4.2 Bearings and their description
4.3 Types of compasses - prismatic compass
4.4 Major uses and problems of compass survey - local attraction
4.5 Sources of errors and commonly accepted proportional errors
4.6 Instruction on field applications

5.0 Levelling **10**

5.1 Need of vertical measurement - concept of vertical, level and horizontal lines
5.2 Principles of levelling - differential levelling

5.3 Levelling instruments and accessories - abney level, clinometer, tilting level, automatic level, staves and foot plates
5.4 Temporary and permanent adjustment of a level - two peg and princeton test
5.5 Reference points - bench marks
5.6 Booking methods and their reductions - arithmetic checks
5.7 Longitudinal and cross - sectioning
5.8 Sources of errors - classification of levelling in terms of precision
5.9 Instruction on field work

6.0 Theodolite Surveying **6**

6.1 Types and uses of theodolites
6.2 Principles of theodolites construction
6.3 Principles of operation and methods of reading
6.4 Temporary adjustments and measuring horizontal and vertical angles
6.5 Setting out of alignments
6.6 Sources of error in thedolite surveying
6.7 Instruction on field application

7.0 Triangulation and Trilateration **4**

7.1 Principles and classification of triangulation
7.2 Relevance of tri-lateration with the use of EDM
7.3 Instructions on field applications

8.0 Plane Tabling **6**

8.1 Historical background of plane tabling
8.2 Principles and methods of plane tabling (Traversing & detailing)
8.3 Sources of errors in plane tabling
8.4 Advantages and disadvantages of plane tabling
8.5 Instructions on field works

Laboratories:

Four laboratory exercise will be performed in this course. These are:

(a) A field survey using chains, tape, ranging.
(b) A field survey using compass.
(c) A levelling field survey to determine profile and cross-section.
(d) Traversing and detailing by plane tabling.

Tutorial: Six assignments and two quizzes

Textbook:

1 "Surveying, A Bannister and S. Raymond, English Language Book Society (ELBS), latest edition.

2 "Surveying", Dr. B.C. Punima, Khanna Publishers, latest edition.

SURVEYING II
EG 565 CE

Lecture : 3 **Year : 2**
Laboratory :3 **Part : B**

		HOURS
1.0	**Traversing**	**7**
1.1	Needs and significance of traversing	
1.2	Reduction of leading to angle and bearings	
1.3	Computation of co-ordinates	
1.4	Closing error and its traverse survey	
1.5	Booking and plotting of traverse survey	
1.6	Effects of errors and scales	
1.7	Instructions on field applications	
2.0	**Techeometry**	**6**
2.1	Principles of optical distance measurement	
2.2	Stadia methods - tangential, vertical staff and subtense bar	
2.3	Booking and plotting - use of tables	
2.4	Sources of errors	
2.5	Instruction on field work	
3.0	**Trigonometrical Levelling**	**4**
3.1	Problems of heights and distances	
3.2	Reciprocal trigonometrical levelling	
3.3	Its significance and error ratio	
3.4	Instruction on field applications	
4.0	**Contouring**	**5**
4.1	General	
4.2	Contour interval and characteristics of contours	
4.3	Method of contouring	
4.4	Instruction on field works	
5.0	**Orientation**	**4**
5.1	Intersection and resection	
5.2	Two point and three point problems and their significance	
5.3	Instruction on field applications	
6.0	**Curves**	**7**
6.1	Types of curves and their common uses	
6.2	Simple circular curves and their elements	
6.3	Setting out of simple circular curves by ordinate from long chord, by offset from tangents and by deflection angles	
6.4	Instruction to transition curves	
6.5	Instructions on field applications	
6.6	Elements of vertical curves and its setting out	

7.0 Hydrographic Survey **7**

7.1 Measurement of velocity and flow
7.2 Vertical and horizontal controls and measurement of cross-section
7.3 Sextant and sounding
7.4 Echo-sounding
7.5 Instructions on field applications

8.0 Photogrametry and Remote Sensing **3**

8.1 Introduction to photogrametry as a branch of surveying
8.2 Merits and limitations of photogrametry
8.3 Introduction to remote sensing

9.0 Field Astronomy and G.P.S. System **2**

9.1 Problems of horizontal control
9.2 Merits of field astronomy and GPS system for horizontal control in civil engineering problems

Laboratories:

Seven laboratory exercise will be performed in this course. These are :

(a) Traverse survey, computation and plotting.
(b) Application of tachenometry to measure distance by the stadia system, including detailing, computation and plotting.
(c) Angle measurement and alignment fixation by the repetition method.
(d) Intersection and resection using the theodilite.
(e) Trigonometrical levelling.
(f) Contouring.
(g) Setting out of levelling.

Textbook:

1 "Surveying", A Bannister and S. Raymond, English Language Book Society (ELBS), latest edition.

2 "Surveying", Dr. B.C. Punmia, Khanna Publishers, latest edition.

Notice:

A two-week survey field camp should be arranged at the beginning of third year. The survey project would be decided upon by the Survey Instruction Committee.

SURVEYING III
(Elective)

Lecture : 3 **Year : 4**
Laboratory :3 **Part : B**
Tutorial : 1

		HOURS
1.0	**Theory of Errors**	**8**
1.1	Introduction	
1.2	Definition of terms	
1.3	Classification of errors	
1.4	Weighted observations	
1.5	Confidence intervals	
1.6	Propagation of systematic and random errors	
1.7	Negligibility criterion	
1.8	Least square method of adjustment of errors	
2.0	**Advanced Triangulation**	**6**
2.1	Introduction to EDM Instruments	
2.2	Types of EDM Instruments and their relevance	
2.3	Principles of EDM	
3.0	**Spherical Trigonometry and Field Astronomy**	**7**
3.1	Concepts and definition of terms	
3.2	Introduction to the study of celestial bodies	
3.3	Solution of the spherical triangle and Napier's rule	
3.4	The Nautical Almanac	
3.5	Determination or the Azimuth by sun observation	
3.6	Corrections to sun observations	
4.0	**Photogrammetry**	**8**
4.1	Historical development of photogrammetry as a technique for map making	
4.2	Terrestrial and aerial photogrammetry	
4.3	Geometry of air survey camera and photograph	
4.4	Principles of height and distance	
4.5	Stereoscopy	
5.0	**Applications of Photogrammetry**	**4**
5.1	Use of photogrammetry in civil engineering problems	
5.2	Other usages in special problems	
5.3	Limitations of Photogrammetry	
6.0	**Remote Sensing**	**5**
6.1	Introduction and definitions	
6.2	Explanation of the concept	
6.3	Use in engineering problems	

7.0 Cartography **4**

7.1 Introduction
7.2 Problems and significance of cartography
7.3 Use in engineering problems

8.0 Overall Review **3**

8.1 Review of different surveying instruments
8.2 Review of different surveying techniques
8.3 Comparison between the various techniques

Laboratories:

Four laboratory exercise will be performed in this course. These are :

(a) EDM traversing.
(b) Determination of azimuth by sub observation
(c) Stereoscopic viewing of aerial photographs.
(d) Visit to topographic department.

Tutorial:

Seven assignments.

Textbook:

1 "Advanced Surveying", P. Som and B.N. Ghosh, Jadavpur University, Calcutta, Tata McGraw Hill Publishing Co., latest edition.

COURSE
IN
WATER RESOURCES ENGINEERING

These courses which include fluid mechanics, hydraulic, hydrology, irrigation and hydro-power engineering, are aimed at teaching students the concepts of water resources engineering and their application in the field of civil engineering. Fundamentals of fluid mechanics, hydraulic and hydrology are taught at an early stage in the program to precede the application phase covered in the irrigation and hydro-power engineering courses. These two latter courses are taught in the last year of the program.

Three sets if experimental assignments in hydraulics are included to supplement the material covered nit he fluid mechanics, hydraulic and hydrology course. The first set covers the basic principles of hydraulics. The second set deals with experimental assignments on the application of the principles of different flow situations. The third set covers experiments on dynamic machines.

The irrigation and hydro-power engineering courses include case studies of real irrigation and hydro-power project in the country. The students are expected to submit short technical reports on these projects to demonstrate their understanding of the course material.

The material covered in the water resources courses is of sufficient content and depth as to allow graduation student to pursue a successful civil engineering career or to be higher studies and research in the field of water resources engineering.

FLUID MECHANICS
EG 524 CE

Lecture : 3 **Year : 2**
Laboratory :1 **Part : A**
Tutorial : 2

		HOURS
1.0	**Introduction**	**4**
1.1	Basic concepts an definitions	
1.2	Matter as solid, liquid or gas	
1.3	Applications of fluid mechanics continuum concept	
1.4	Effects of shear stress on solid	
1.5	Classification of fluid as Newtonian and Non-Newtonian	
1.6	Ideal and real fluid	
1.7	Concept of control volume	
2.0	**Physical Properties of Liquid**	**3**
2.1	Mass, density, specific weight and specific volume	
2.2	Compressibility, vapour pressure and surface tension	
2.3	Viscosity and Newton's Law of viscosity	
3.0	**Fluid Pressure and Its Measurement**	**5**
3.1	Intensity of pressure	
3.2	Pressure/Depth relationship	
3.3	Pressure at a point and pressure relationships	
3.4	Pascal's Law	
3.5	Measurement of pressure	
3.6	Differential principle and its use	
3.7	Bourden gauge	
4.0	**Pressure on Submerged Surfaces**	**4**
4.1	Pressure diagram on plane surfaces	
4.2	Pressure on curved surfaces	
4.4	Forces on gates, dams and other water retaining structures	
5.0	**Equilibrium Stability of Floating Bodies**	**5**
5.1	Flotation concept	
5.2	Thrust of immersed surfaces and archimedes principles	
5.3	Condition of equilibrium stability of floating bodies	
5.4	Meta centre, meta centric height and its determination	
5.5	Fluid within a rigid body subjected to motion (acceleration and rotation)	
6.0	**Fluid Kinematics**	**6**
6.1	Lagrangian and Elulerian approaches of describing fluids flow	
6.2	One, two and three dimensional flows	
6.3	Cartesian and polar co-ordinates	
6.4	Discharge and mean velocity of flows	

6.5 Stream lines, streak lines, path lines, stream tube
6.6 Classification of fluid flow, steady and unsteady, uniform and non-uniform with time and space criteria, respectively.
6.7 Classification of fluid flow according to space criterion (uniform and non-uniform)

7.0 Dynamics of Flows 6

7.1 Various forces acting on a fluid
7.2 Euler's equation of motion and its application
7.3 Derivation of Bernoulli's equation from Euler's equation
7.4 Energy of steady fluid flow
7.5 Bernoulli's theorem
7.6 Introduction to Navier stokes equation
7.7 Flow past submerged bodies, drag and lift forces, drag on a sphere and cylinder
7.8 Boundary layer definition, concept, thickness and theory

8.0 Flow Through Orifices 5

8.1 Orifice flow
8.2 Application of Bernoulli's equation to orifice flow
8.3 Venturimeter, orifice meter and Nozzlemeter
8.4 Principle of application to Notches and Weirs
8.5 Varying head flow such as in emptying and filling of tanks

9.0 Momentum and Other Analysis 7

9.1 Derivation of momentum equation
9.2 Application of equation of calculate forces on pipe bends and reducers
9.3 Forces exerted by jets on stationary and moving vanes of different shapes
9.4 Concept of angular momentum
9.5 Rayleighs methods, Bucklingham theorem

Laboratories:

Six laboratory exercise will be performed in this course. These are :

(a) Newton's law of viscosity
(b) Hydrostatic force on a sybnerged body
(c) Stability of a floating body
(d) Verification of Bernoulli's theorem
(e) Impact of flow jet
(f) Flow through edged orifice

Tutorial:

Six assignments and two quizzes.

Textbook:

1 "Fluid Mechanics and Hydraulics", Dr. J. Lal, Metropolitan Books Co. Pvt. Ltd., Delhi, 1987.

2 "Fluid Mechanics", R.J. Garde.

3 "Fluid Mechanics", Webster.

HYDRAULICS
EG 564 CE

Lecture : 4 **Year : 2**
Laboratory :1 **Part : B**
Tutorial : 2

HOURS

1.0 Flow Through Pipes **5**

1.1 Introduction to pipe flow and uses of continuity equation
1.2 Laminar and turbulent regimes of flow Reynols's equation
1.3 Classification of Head-loss and its relationship with flow parameters
1.4 Hydraulic and energy grade lines
1.5 Derivation of Weishbach-Darcy's formula, Calebrooks-White's equation and its development, use of Moody's chart
1.6 Shear stresses and their distribution in uniform flow
1.7 Methods for reduction of hydraulic frictions
1.8 Three types of pile flow problem and its solution

2.0 Syphons **2**

2.1 Definition, condition of application
2.2 Condition for continuos supply

3.0 Pipe Networks **4**

3.1 Short and long pipes with constant diameters
3.2 Pipes in series and parallel
3.3 Economic diameter of pipes
3.4 Pipe network by Hardy-Cross method
3.5 Three reservoir problem and its solution

4.0 Unsteady Flow in Pipes **5**

4.1 Water hammer and its effects in pipes and pen stock
4.2 Variation of pressure due to sudden closure of valve for the cases of rigid and elastic pipes
4.3 Velocity distribution of wave pressure
4.4 Water hammer due to gradual closure of valve
4.5 Relief devices against action of water hammer

5.0 Open Channel Flow **6**

5.1 Open channel as mode of water transportation
5.2 differences between pipe flow and open channel flow
5.3 Classification and shapes of open channels
5.4 Geometric properties of channels: including area of flow, wetted perimeter and hydraulic radius
5.5 Classification of open channel by times, space and hydraulic regime
5.6 Economic channel section in plain and in hill regions

6.0 Uniform Flow **5**

6.1 Conditions of uniform flow in a prismatic channel
6.2 Introduction to shear stress and velocity distribution
6.3 Manning's equation for Chezy's coefficient (C)
6.4 Relationship between Chezy's coefficient (C), Manning and Darcy's Coefficient
6.5 Resistance coefficients
6.6 Types of flow problems and solutions

7.0 Flow Over Notches and Weirs 4

7.1 Types, as broad and sharp crested weirs, and different shapes
7.2 Discharge equation for rectangular, triangular and trapezoidal weirs - Francis Formula
7.3 Consideration of approach velocity and Notch ventilation
7.4 Advantages of notches

8.0 Non-Uniform Flow in Open Channel 4

8.1 Energy and momentum principle for open channel flow
8.2 Specific energy, critical depth, alternate depths of flow, and depth/discharge relationship
8.3 Use of specific energy concept in analyzing flow over broad crested weirs, flumes and venturi flumes
8.4 Concept of specific force

9.0 Gradually Varied Flow 5

9.1 Description of water surface profile behind dams and other water retaining structures
9.2 Governing equations of gradually varied flow and assumptions in their derivations
9.3 Classification of slopes
9.4 Graphical and numerical solutions of the gradually varied flow equation

10.0 Hydraulic Jump and Its Analysis

10.1 Flow conditions for jump
10.2 Local phenomenon mechanism of energy
10.3 Dependence upon initial fraude number
10.4 Practical examples of jump at spillway toe, fall, etc.

11.0 Flow in Mobile Boundary Channel 5

11.1 Difference between mobile boundary channels and rigid boundary alluvial channels
11.2 Effect of shear stresses and incipient motion critical tractive stress
11.3 Shield's approach of predicting critical tractive stress
11.4 Regimes of flow, types of bed forms and values of Manning's coefficients for various bed forms

12.0 Similitude and Physical Modelling 6

12.1 Definition and types of similarities
12.2 Definition and types of models, necessity of model studies
12.3 Modelling criteria

12.4 Introduction to distorted and undistorted models
12.5 Introduction to scale effects in model studies

Laboratories:

Six laboratory exercise will be performed in this course. These are :

(a) Flow through venturimeter.
(b) Reynold's experiment.
(c) Head loss in a pipe line.
(d) Flow through open sluice gate.
(e) Hydraulic jump in open channel.
(f) Flow over broad-crested weir.

Tutorial:

Two home assignments and solution of numerical problems on topics taught in the lectures.

Textbook:

1 "Fluid Mechanics and Hydraulics", Dr. J. Lal, Metropolitan Books Co. Pvt. Ltd., Delhi, 1987.

2 "Flow Through Open Channel", K.G. Ranga, Raju, Tata McGraw-Hill Publishing Company Ltd., New Delhi 1986.

ENGINEERING HYDROLOGY
EG 664 CE

Lecture : 3 **Year : 3**
Laboratory :1 **Part : B**
Tutorial : 1

		HOURS
1.0	**Introduction**	**4**
1.1	Hydrology as a Science of water	
1.2	Scope and application to engineering	
1.3	The hydrological cycle	
1.4	Influence of hydrology on agriculture and forestry	
1.5	Water balance equations in different parts of the world	
1.6	Development of hydrological study in Nepal	
2.0	**Meteorological Factors in Hydrology**	**3**
2.1	Radiation	
2.2	Temperature	
2.3	Humidity	
2.4	Wind speed	
2.5	Evaporation and evapotranspiration, use of Penman's equation	
3.0	**Physical Hydrology**	**10**
3.1	Precipitation, its causes, classification and measurement by raingauges	
3.2	Types of raingauges and errors in measurement	
3.3	Double mass curve method of adjustment	
3.4	Analysis of point rainfall by three methods	
3.5	Intensity duration curves	
3.6	Snow fall and its measurement	
3.7	Infiltration and its role in distributing water to ground water	
3.8	Interflow and percolation infiltration rate	
3.9	Factors affecting infiltration rate and capacity	
4.0	**Surface Runoff**	**7**
4.1	Rainfall-runoff correlation and rating curves	
4.2	Stream gauging, selection of site and selection of gauges	
4.3	Stream flow measurement by the velocity area method	
4.4	Measurement of areas and velocities	
4.5	Current meters, their use and calibration	
4.6	Flow measurement in a river cross-section	
4.7	Velocity measurement by floats and by surface and subsurface velocity rods	
4.8	Slope area method of computing discharge	
4.9	Discharge measurement by using notches and weirs	
4.10	Factors affecting runoff from a catchment	
5.0	**Hydrograph Analysis**	**6**
5.1	Hydrographs and their analysis	

5.2 Unit hydrographs and their limitations
5.3 Derivation of unit hydrographs from storms
5.4 Peak flow estimation using empirical methods
5.5 The rational method and its limitations

6.0 Statistical Hydrology 6

6.1 Frequency and probability concepts
6.2 Frequency analysis and recurrence interval
6.3 Gamma and student's distribution, and their application in hydrology
6.4 Gumbel's method in hydrology

7.0 Ground Water 5

7.1 Occurrences and distribution of ground water aquifers, aquiclavels and artesian wells
7.2 Water wells and their types
7.3 Wells and their classification
7.4 Devices for testing of wells
7.5 Role of ground water in irrigation development
7.6 Well hydraulics
7.7 Recharge of ground water
7.8 Pumps for the water well

8.0 Hydrology of Floods 4

8.1 Definition, causes and effects of floods
8.2 Hydro-geomorphological characteristics of rivers
8.3 Flood prediction and design flood
8.4 Flood prediction and design flood
8.5 Methods of mitigating floods

Laboratories:

Three laboratory exercise will be performed in this course, in addition to an observation tour for a hydrological station on which each student, submits a brief report. These are :

(a) Use of current meter in determining flow velocity in the laboratory.
(b) Discharge measurement of stream, by float method in the field.
(c) Discharge computation by velocity-area method.

Tutorial:

(a) Two home assignments for assessment.
(b) Explanation, in tutorials, of solutions of numerical problems on topics taught in the lectures.
(c) One study tour to hydrological stations and each student should prepare a brief report on the basis of prescribed data-format.

Textbook:

1 "Engineering Hydrology", R.S. Varshney, Nem Chand and Bros., Roorkee.
2 "Engineering Hydrology", Subramaniya.

3 "Hydrology for Engineers", Linsley Kobler and Paulhus, McGraw-Hill Publishing Company.

IRRIGATION ENGINEERING
EG 724 CE

Lecture : 3 **Year : 4**
Tutorial : 2 **Part : A**

HOURS

1.0 Introduction **2**
- 1.1 Definition of irrigation
- 1.2 Function of irrigation and its advantages
- 1.3 Status of irrigation development in Nepal

2.0 Solid Moisture and Crop Relationships **3**
- 2.1 General classification of soil for agricultural purposes
- 2.2 Soil moisture/crop-water requirement
- 2.3 Factors affecting crop-water requirements
- 2.4 Crop-water requirement calculation by Penman method and computer software
- 2.5 Principal crops, their seasons and their water requirements

3.0 Method of Applying Water in Irrigation Fields **2**
- 3.1 Surface, subsurface and sprinkler methods
- 3.2 Techniques of surfaces irrigation and their suitability
- 3.3 Advantages and disadvantages
- 3.4 Problems of sprinklers

4.0 Canals **5**
- 4.1 Classification of canals according to function
- 4.2 Types of permanent and inundation canals
- 4.3 Components of the canal system head work, major canal, branch canal, distributary and water courses
- 4.4 Canal alignment
- 4.5 Canal losses due to seepage and evaporation
- 4.6 Assessment of water requirement in canals command area
- 4.7 G.C.A., C.C.A., N.C.A., Duty delta and their relationships
- 4.8 Base period, Kor period and Kor depth

5.0 Design of Canals **7**
- 5.1 Use of manning uniform flow equation for canal design
- 5.2 Semi-theoretical approaches of canal design
- 5.3 Design of Stable canal in alluvium
- 5.4 Silt theory of Kennedy and Lacy
- 5.5 Uses of Garrets and other diagrams
- 5.6 Lined canals, various types of lining, advantages and economics of lining
- 5.7 Design of lined canals
- 5.8 Cross-section of canal, berms, banks, roadways and spoil banks
- 5.9 Specific design considerations for hilly irrigation canals

6.0 Hydraulic Structures **6**

6.1 Headworks: their types, function and components
6.2 Bed sediment control at headworks: silt excluder, silt extractor and their types
6.3 Types of cross-drainage structures, conditions of applications and their designs, escapes
6.4 Design considerations of canal drop and series of drops, conditions of applications and their designs
6.5 Distributory head and other regulation of flow discharges, and their designs
6.6 Specifics of design considerations for hydraulic structures in plain and hilly regions
6.7 Considerations for local materials in designs

7.0 Seepage Flow **3**

7.1 Definitions, flow past structures
7.2 Safety against piping and uplift
7.3 Principle of design for sub-surface flow of structures, Khosla'a theory

8.0 Distribution Systems **2**

8.1 Water management and its control
8.2 Different types of canal outlets
8.3 Design considerations

9.0 Water Logging and Drainage **5**

9.1 Courses and effects of water logging
9.2 Preventive measures of water logging
9.3 Surface drainage and drainage of irrigated land
9.4 Reclamation of water logged areas by different methods
9.5 Sub-surface irrigation and drainage system, and their combination

10.0 River Control **6**

10.1 River training and its necessity
10.2 Stages of rivers and their meandering process
10.3 Methods of river training
10.4 Effects of degradation of the river structures
10.5 Flood control and its necessity
10.6 Methods of flood control
10.7 Navigation possibilities in Nepalese rivers

11.0 Planning and Management of Irrigation System **4**

11.1 General irrigation system planning
11.2 Organization and irrigation management
11.3 Development of a small scale irrigation project
11.4 Operation and maintenance of irrigation systems
11.5 Institutional aspects of irrigation system management

Tutorial:

(a) Two home assignments for assessment.
(b) Solution, in tutorials, of numerical problems on topics taught in the lectures.

(c) One observation tour of an irrigation project and each student should prepare a brief report on the basis of prescribed data-format.

Textbook:

1. "Theory and Design of Irrigation Structures", Volumes I and II, R.S. Varshney, S.C. Gupta and R.L. Gupta, Nem Chand and Bros., Roorkee, 1979.
2. "Fundamentals of Irrigation Engineering", Bharat Singh, Nem Chand and Bros., Roorkee 1983.
3. "Design Manual for Irrigation Projects in Nepal", PDSP Manuals, February, 1990.
4. "Irrigation Development in Nepal", S.N. Poudel, Kathmandu, 1988.
5. "Irrigation Engineering and Hydraulic Structures", S.K. Garg, Delhi, 1983.
6. "Design Gaudlines for Surface Irrigation in Terai and Hills of Nepal", Volumes I and II, WECS, Kathmandu, 1988.

HYDRO POWER ENGINEERING
EG 764 CE

Lecture : 3 **Year : 4**
Laboratory :1 **Part : B**
Tutorial : 2

HOURS

1.0 Introduction **4**

1.1 Power situation in Nepal and world: Historical background, thermal, water and electrical power, and their development

1.2 Sources of hydropower potential: Definition and types; surface flow; ground water and oceans; gross, technical and economical potentials

1.3 Hydropower plants: types and classification based on energy, storage capacity and head; pump storage plant

2.0 Power Regulation **4**

2.1 Definition and meaning: firm (or primary) and secondary power, plant and installed capacity; mean and peak load; load curve, load capacity, utilization and diversity factors

2.2 Power variation: daily, weekly, monthly and annual variations or power

2.3 Power grid: introduction and components of power system

3.0 Planning of Hydropower Projects **6**

3.1 Site Selection: reconnaissance, preliminary, hydrological, geological and final investigations

3.2 Requirements for hydropower: flow duration curves, mass curves of flow and their uses, energy flow diagramme, gross and net head, power estimation, its demand and prediction

3.3 Reservoir regulation: peak and normal flow discharges, distribution of sediments and their control, life of reservoirs

3.4 Layout of hydropower projects: storage, diversion and pump storage types with intake, forebay, surge tanks, penstock, powerhouse, supply conduit, casing, draft tube and tailrace canal

4.0 Water Retaining Structure **9**

4.1 Dams: classification based on function and head; forces acting on dams

4.2 Materials for dams: earth soil, boulder, rock and concrete

4.3 Site selection for dams: available materials, topography, economy, etc.

4.4 Foundation treatment: types of grouting and their necessity; remedies against piping and exit gradient

4.5 Design of concrete gravity dams; safety factor against overturning, sliding, floating, free-board

4.6 Design of earthen dams: general considerations; safety, factor against slope stability; phreatic line, seepage flow discharge

5.0 Regulating Structures **10**

5.1 Intake: importance, location and types; design of intake structures

5.2 Hydraulic tunnels: definition; rock pressure, hardness coefficient of rocks; pressure and non-pressure tunnels, their types and design; headloss in pressure tunnels; design of tunnel lining

5.3 Settling basin: characteristics of suspended sediments-settling velocity, horizontal velocity and lifting velocity; types of settling basin and its location, settling basins with periodical and continuous flushing; components of basins and their designs

5.4 Forebay and surge tanks: importance, location condition of their application, and design of forebay structure

5.5 Penstock liners: importance, location, condition of their application; hydraulic hammer; hydrodynamic pressure calculation; turbine head and determination of penstock diameter

6.0 Spillways 6

6.1 Design of spillway: definition, purpose, types, design specifics; types of gates and their location; occurrence of cavitation and cavitation erosion

6.2 Energy dissipation: types of energy dissipators and their necessity; role of tailwater depth

6.3 Design of stilling basin

7.0 Hydro-Electrical Machines 6

7.1 Hydro-mechanical installation: turbines - Pelton, Francies, Kaplan and their performance characteristics; selection of turbines and their specific speed; introduction to bulb turbine; draft tube, tailrace canal and their importance. Pumps-centrifugal, reciprocating and their performance characteristics, selection and starting speed

7.2 Electro-mechanical installation: generators and their types; purpose and working principle of governors, classification and dimensions of powerhouse

Laboratories:

Six laboratory exercise will be performed in this course. These are :

(a) Performance characteristics of a Pelton turbine
(b) Performance characteristics of a Francis turbine
(c) Characteristics of Kaplan turbine
(d) Characteristics of open channel flume
(e) Characteristics of centrifugal pump
(f) Characteristics of pressure channel flume

Tutorial:

(a) Two home assignments for assessment.
(b) Solution, in tutorials, of numerical problems on topics taught in the lectures.
(c) One observation tour of a hydropower project and each student should prepare a brief report on the basis of prescribed data-format.

Textbook:

1 "Water Power Engineering", M.M. Dandekar and K.N. Sharma.
2 "Hydraulic Structures", M.M. Grishin, Mir Publishers, Moscow, 1982.

3 "Hydropower Structures", R.S. Varshney, Nem Chand and Bros., Roorkee, 1986.

4 "Hydraulic Machines", G.I. Krivchenko, Mir Publishers, Moscow.

COURSES
IN
PUBLIC HEALTH ENGINEERING

The main objectives of these courses is to provide students with a sound knowledge in the subjects of Water Supply, Sanitary Engineering, and the Environment. The Water Supply Engineering course is aimed at teaching the students the chemistry and microbiology of water, water resources and their utilization for water supply, water intake construction, construction of water mains and distribution systems, and water treatment technology. The course also provides the students with a good knowledge in system and management of water supply engineering. The laboratory work is expected to give the students an in-depth feeling of the subject.

The course is Sanitary Engineering aims at providing the students with a fairly advanced knowledge of the sewerage system, sludge treatment and its disposal. After completing the course, the students are expected to know how to solve the problems of waste water solid disposal and sanitary management of towns and villages.

The third course of Technology, Environment and society is intended to introduce the student to the history to technology and the problems created by human technological activities. Some of the adverse impacts of these activities of the environment and public health are covered in the course. Also, the present international efforts that are directed towards finding solutions for the global problems of pollution, acid rain and the green house effect are discussed.

WATER SUPPLY ENGINEERING
EG 628 CE

Lecture : 3 **Year : 3**
Laboratory :1 **Part : A**
Tutorial : 1

HOURS

1.0 Introduction **2**

1.1 Objective of water supply, - immediate and long term impact of water supply
1.2 Portable, contaminated and wholesome water (definition), typical components of water supply schemes
1.3 Essentials of water supply engineering

2.0 Sources of Water **4**

2.1 Surface source: lake, streams/rivers and impounded reservoirs
2.2 Underground sources: springs, wells and infiltration galleries
2.3 Selection of water sources

3.0 Quantity of Water **4**

3.1 Types of water demand: domestic, livestock, commercial, industrial and public uses, fire fighting, losses and wastage control measures, per capita demand
3.2 Design period: definition, selection basis
3.3 Methods of population forecasting and present it as follows:
  3.3.1 Mathematical method - Arithmetical, geometric/increment increase, decrease rate of growth
  3.3.2 Graphical method - extension and comparison
3.4 Variation in demand of water
3.5 Factors affecting demand of water
3.6 Methods of population forecasting: Arithmetical/Geometrical/Incremental increase methods, decrease rate of growth method and graphical extension and comparison method

4.0 Quality of Water **5**

4.1 Impurities in water, their classification and effects
4.2 Hardness of water, types of hardness, Alkalinity in waters
4.3 Components of the canal system, Living organism in water: virus, algae, worms and bacteria
4.4 Water born diseases: water-borne, water-washed, water-based, water-vector, etc.
4.5 Physical, chemical and biological examination of water: tests for temperature, colour turbidity, pH, solids, D.C.: introductory bacteriological tests, membrane filter, multiple-tubes
4.6 Water quality standard, WHO standard for domestic use

5.0 Intake Works **3**

5.1 Site selection of an intake
5.3 Characteristics of river reservoir and springs intakes

6.0 Water Treatment **14**

6.1 Objectives of water treatment

6.2 Treatment Systems:

Screening:

Purpose, coarse and fine screens

Plain sedimentation:

Purpose, theory of settlement, effect of temperature on settlement, ideal sedimentation tank, design of sedimentation tank, and types of sedimentation tanks

Sedimentation with coagulation:

Purpose, types of coagulants, determination of optimum dose of coagulant, flocculation and clarifier

Filtration:

Purpose, theory of filtration, construction, operation and maintenance of slow sand, rapid sand and pressure filters

Disinfection:

Purpose, cholorination, chlorine dose, residual chlorine, contact time, forms of chlorination, plain chlorination, break-point chlorination, super chlorination and de-chlorination, factors affecting chlorination

Softening:

Removal of temporary hardness by boiling and lime treatment, removal of permanent hardness by lime soda, zeolite and ionization processes

Miscellaneous treatments:

Methods of aeration, removal of iron and manganese, and removal of colour, odour and taste

7.0 Reservoirs and Distribution System **6**

7.1 Clear water reservoir, service reservoir, balancing reservoir and its capacity determination

7.2 System of supply

7.3 Layout of the distribution system

7.4 Design of the distribution system

8.0 Conveyance of Water **3**

8.1 Pipe material types: CI, GI, WI, Steel, concrete, AC and PVC

8.2 Laying of pipes

8.3 Pipe joints and their types

9.0 Valves and Fittings **4**

9.1 Valve types: sluice valve, reflux valve, safety valve, air valve and drain valve

9.2 Fittings: stop cocks, water taps, bends and break-pressure tank

9.3 Public stand post

9.4 Maintenance of the water supply system

Laboratories:

Four laboratory exercise will be performed in this course. These are :

(a) Physical tests of water: temperature, colour, turbidity, and pH.
(b) Determination of suspended, dissolved and total solids in water.
(c) Determination of dissolved oxygen in water by Winkler method and D.O. meter.
(d) Determination of optimum dose of coagulant by the jar test.

Tutorial:

6 assignments and 2 quizzes.

Textbook:

1 "Water Supply and Sanitary Engineering", G.S. Birdie, Dhanpat Rai and Sons Publishers.

SANITARY ENGINEERING
EG 668 CE

Lecture : 3 **Year : 3**
Tutorial : 1 **Part : B**

HOURS

1.0 Introduction **2**

1.1 Importance of waste water and solid waste management
1.2 Objects of sewage disposal
1.3 Sanitation systems: conservancy system and water carriage system
1.4 Types of sewerage systems: combined, separate and partially separate systems

2.0 Quantity of Waste Water **3**

2.1 Sources of sanitary sewage
2.2 Factors affecting sanitary sewage
2.3 Determination of quantity of sanitary sewage
2.4 Determination of quantify of storm water, tangent method; limitation of rational method

3.0 Characteristics and Examination of Sewage **5**

3.1 Sampling of sewage
3.2 Physical, chemical and biological characteristics of sewage
3.3 Decomposition of sewage, aerobic and anaerobic reactions
3.4 Biochemical oxygen demand (BOD) and chemical oxygen demand (COD)
3.5 Tests, of solids, DO, pH-value, brief review of, water supply, BOD, COD, Nitrogen, chloride demand, chloride

4.0 Design and Construction of Sewers **5**

4.1 Typical design periods, flow velocity, flow diagrams, hydraulic formulae and gradients
4.2 Shape of sewers
4.3 Sewer materials: requirements, salt glazed stoneware, C.I. and cement concrete pipes
4.4 Design of the sewer for separate and combined systems
4.5 Construction of sewer: excavation, laying, joining of sewer testing of sewer: water test, air-test

5.0 Sewer Appurtenances **4**

5.1 Manholes, drop-manholes and lampholes
5.2 Street inlets
5.3 Catch basins
5.4 Flushing devices
5.5 Sand, Grease and oil traps
5.6 Inverted siphons
5.7 Sewer outlets
5.8 Ventilating shaft

6.0 Sewage Disposal **6**

6.1 Meaning and objects of sewage disposal

6.2 Sewage disposal by dilution: process, essential condition for dilution, self-purification of streams, factors affecting self-purification, the oxygen sag curve, streeter-phelps equation

6.3 Sewage disposal by land treatment: process, suitability of land treatment, methods of land treatment irrigation, overlandflow and rapid filtration

7.0 Sewage Treatment **10**

7.1 Objects of treatment, treatment methods: physical, chemical, biological

7.2 Preliminary treatment processes: racks or screens, skimming tanks, grit chamber, sedimentation, and chemical precipitation

7.3 Secondary treatment processes and their types

7.4 Principles of biological treatment, principle of suspended and attached growth process

7.5 Sewage filtration, intermittent sand filter, contact bed, trickling filters, bio-filters and design of trickling and bio-filters

7.6 Activated sludge process: theory, design and aeration, advantages and disadvantages of the activated sludge process

7.7 Oxidation ponds: functions, theory and design

8.0 Sludge Treatment and Disposal **4**

8.1 Sources of sludge and necessity of treatment

8.2 Aerobic and anaerobic digestion

8.3 Methods of sludge treatment: grinding and blending, thickenning, stabilization, dewatering, drying, compositing and incineration

8.4 Methods of sludge disposal: spreading on land, lagooning, dumping, and land filling

9.0 Disposal of Sewage from Isolated Buildings **4**

9.1 Privies: Pit privy, ventilation improved pit latrine, and pour-flush latrine

9.2 Septic Tan: design, construction, working and maintenance

9.3 Disposal of septic tank effluent: drain field, soak its, watching, evapo-transpiration mounds

10.0 Solid Waste Cesspools and Evapotranspiration Mounds **2**

10.1 Types and characteristics of solid waste

10.2 Collection and disposal

10.3 Methods of solid waste disposal: dumping, sanitary landfill, incineration and composting

Tutorial:

3 assignments and 2 quizzes.

Textbook:

1 "Water Supply and Sanitary Engineering", G.S. Birdie, Dhanpat Rai and Sons Publishers.

Practical Work:

Following practical exercises should be conducted:

(a) BOD and COD tests.

(b) Bacteriological tests: membrin filter, most probable number.

TECHNOLOGY, ENVIRONMENT AND SOCIETY
EG 767 CE

Lecture : 2 **Year : 4**
Tutorial : 2 **Part : B**

HOURS

1.0 Introduction **4**

1.1 The civilization between 3000 B.C. and 1660 A.D.
1.2 The time of the early industrial revolution between 1660 and 1815
1.3 The industrial revolution in Maturity between 1815 and 1918
1.4 Influence of the first and second world wars on technology

2.0 The Technological Society **5**

2.1 The machine age
2.2 The stream locomotive and its impact on transportation
2.3 The telephone and telegram and their impact on telecommunication
2.4 The automobile and its impact on mobility
2.5 Development of electronics and the silicon chips
2.6 The computer and its impact
2.7 Information as a source of knowledge and power
2.8 The information society
2.9 Importance of technology in the modern house

3.0 Society and the Environment **5**

3.1 Introduction to the environment and ecosystem
3.2 Humans and their impact on the environment
3.3 Garbage collection and disposal
3.4 Sewage disposal and its pollution of the environment
3.5 Industrial waste: its generation, collection and disposal
3.6 Problems resulting from the disposal of sludge and industrial waste in rivers, lakes and canals
3.7 Impact of water pollution on the health of human and animals
3.8 Impact of water pollution on fish life
3.9 Control of the environment

4.0 Technology and the Environment **3**

4.1 The environment of technology
4.2 Technology as a curse and as a blessing
4.3 Technology is now irreversible
4.4 Control of technology's adverse impacts at the design stage of machines
4.5 The gasoline powered engines and the automobile
4.6 Air pollution from automobile and truck emissions

5.0 Technology and Society **5**

5.1 Technology creates the opportunity for society change
5.2 Importance of technology in controlling prices
5.3 Interaction between technology and the labour force

5.4 Society's control of technology
5.5 Effects of emissions from coal and gasoline powered engines on public health
5.6 Benefits of society from new technological inventions
5.7 Technological innovations can unmask old social problems
5.8 Impact of industrialization of societies that are not yet technologised
5.9 Shifts in employment opportunities

6.0 Green House Effects **2**

6.1 Definition
6.2 Factors contributing to the Green House warming effects
6.3 Global impacts on land, water, agriculture, humans, animals, etc.
6.4 Present international efforts towards finding solutions

7.0 Acid Rain **2**

7.1 Causes of acid rain
7.2 Impact of acid rain on water in lakes and rivers
7.3 Impact of acid rain on water and fish life
7.4 Possible treatments

8.0 Technological and Environmental Situation in Nepal **4**

8.1 Industries in Nepal
8.2 Water and Air Pollution
8.3 Impact of technology on the economy in Nepal
8.4 Impact of technology on employment
8.5 Educational needs to accommodate new types of employment
8.6 Impact of technology on social values

Tutorial:

Six assignments and two quizzes.

Textbook:

"Technology Change and Society", Edward C. Pytlek, Donald P. Lauda & David Publications, Inc., Worcester, Massachusetts, 1978.

BUILDING TECHNOLOGY
EG 626 CE

Lecture : 3 **Year : 3**
Tutorial : 1 **Part : A**

HOURS

1.0 Building Sciences **7**

1.1 Moisture and its movement through building components
1.2 Condensation and its reasons
1.3 Effects of moisture and condensation on building components and materials
1.4 The use of vapour barriers and other damp proof courses in buildings
1.5 Thermal properties of building components and materials
1.6 Thermal insulation: thermal resistance and thermal capacity
1.7 Acoustical properties of building materials: absorptive and reflective materials
1.8 Noise control and constructional precautions to reduce noise
1.9 Lighting: natural and artificial
1.10 Energy conscious design: renewable and non-renewable source of energy, active and passive methods of solar cooling and heating

2.0 Foundations and Basements **4**

2.1 Some common problems with existing foundations
2.2 Underpinning of foundations of existing building
2.3 Shoring of existing buildings during foundation strengthening
2.4 Retaining properties and waterproofing of basements
2.5 Sealing of cracks in basements

3.0 Roofs **3**

3.1 Single timber roofs: their types, comparative advantages and some construction details
3.2 Double and triple roofs: situations for their use, their elements and construction details
3.3 Roof coverings; tiles, slates, CCT sheets, etc.

4.0 Staircases **2**

4.1 Elements of staircase
4.2 Types of staircase
4.3 Relationship between rise and tread of stair

5.0 Doors and Windows **3**

5.1 Doors parts: frame, shutter and their details
5.2 Windows: types and details
5.3 Ventilations types and details

6.0 Joints **4**

6.1 Types of joints: construction and expansion joints
6.2 The need for provision of joints
6.3 Treatment and detailing of joints at the roof level

6.4 Treatment and detailing of joints at the floor levels
6.5 Treatment of joints in external walls

7.0 Temporary Construction **3**
7.1 Scaffolding: single and double scaffolds
7.2 Formwork for excavations and trenches
7.3 Formworks for reinforced concrete construction
7.4 Shoring: horizontal, slant and vertical shores

8.0 Cladding and External Finishing **4**
8.1 Load bearing and non-load bearing cladding
8.2 Brick facing
8.3 Cladding in stone
8.4 Cladding in concrete panels and their construction details
8.5 Plastering
8.6 Painting and important properties of the paint

9.0 Internal Finishing **2**
9.1 Non-load bearing partitions: types, functions and methods of connection to the surrounding structure
9.2 Suspended ceilings: types, functions and methods of construction

10.0 Electrical Services **4**
10.1 Residential and commercial requirements
10.2 General principles
10.3 Wiring systems
10.4 Trunkings, busbars and ducts for electrical distribution
10.5 Safety precautions

11.0 Water Supply and Drainage Services **5**
11.1 General principles
11.2 Mains of water supply: storage and distribution system
11.3 Hot water supply
11.4 Drainage of sewage and waste
11.5 Rainwater pipes and gutters
11.6 Septic tanks

12.0 Other Miscellaneous Services in Buildings **4**
12.1 Lifts and escalators: general principles and practices
12.2 Ventilation and heating systems: general principles and construction standards
12.3 Telecommunication
12.4 Air conditioning

Tutorial:

Six assignments and two quizzes.

Textbook:

1 "Understanding Buildings", Reid E., MIT Press.
2 "Construction Principles, Methods & Materials", Olin, H.B.
3 "Building Construction Illustrated", Ching, F.D.K.

ESTIMATING & VALUATION
EG 726 CE

Lecture : 3 **Year : 4**
Tutorial : 3 **Part : A**

HOURS

1.0 Introduction **2**
- 1.1 General
- 1.2 System of units
- 1.3 Units of measurement and payments for items of work and materials
- 1.4 Requirement of estimating

2.0 Method of Estimating **4**
- 2.1 Methods of measurements of building and civil engineering works
- 2.2 Subheads of various items of work
- 2.3 Various methods of taking out quantities: centre line method, long and short wall method, crossing method
- 2.4 Abstracting bills of quantities

3.0 Preparation of Detailed Estimate **2**
- 3.1 Cost of items
- 3.2 Transportation cost, other expenses and overheads
- 3.3 Contingency

4.0 Types of Estimates **3**
- 4.1 Approximate estimates
- 4.2 Detailed estimates
- 4.3 Revised estimates
- 4.4 Supplementary estimates
- 4.5 Annual repair or annual maintenance estimates
- 4.6 Extension and improvement estimates
- 4.7 Complete estimates
- 4.8 Split up of cost of building works

5.0 Analysis of Rates **8**
- 5.1 Introduction
- 5.2 Purposes of rate analysis
- 5.3 Importance of rate analysis
- 5.4 Requirements of rate analysis
- 5.5 Factors affecting the rate analysis
- 5.6 Procedure of rate analysis: for building works, for sanitary and water supply works, for road work, for irrigation works, for suspension bridge works

6.0 Detailed Estimate **18**
- 6.1 Estimate of walls
- 6.2 Estimate for a single room building
- 6.3 Estimate for a two room building

6.4 Estimate of earthwork by three methods
6.5 Estimate of an aqueduct
6.6 Estimate of R.C.C. slab culvert
6.7 Estimate of R.C.C. T-Beam decking
6.8 Estimate of septic tank and soak pit

7.0 Valuation **8**

7.1 Introduction
7.2 Purpose of valuation
7.3 Principles of valuation
7.4 Terms used in valuation
7.5 Methods of Determining value of property
7.6 Methods of valuation report writing

Tutorial:

Five estimation assignments for five different projects:

(a) A double storey residential building
(b) A portion of roadway
(c) A canal fall
(d) A residential toilet
(e) A valuation report of a property

Textbook:

1 "Civil Estimating Quantity Surveying and Valuation", Amarjit Aggrawal, Katson Publishing House, Ludhiana, 1985.

2 "Estimating and Project Management for Small Construction Firms", Seymour Berger and Jules B. Godel, Van Nostradn Reinhold Publishing Company, New York, 1977.

3 Printout Notes Prepared by IOE Teacher, Pulchowk Campus.

MANAGEMENT OF CONSTRUCTION AND MAINTENANCE
EG 776 CE

Lecture : 3 **Year : 4**
Tutorial : 2 **Part : B**

HOURS

1.0 Specifications **4**

1.1 Purpose of specifications
1.2 Types of specifications: general and detailed specifications
1.3 Specification writing - techniques, use of international and local standards, code of practice
1.4 Importance of specifications

2.0 Contractual Procedure **6**

2.1 Method of execution of work
2.2 Types of contract
2.3 Tender and Tender notice
2.4 Tender guarantee
2.5 Preparation before inviting tender
2.6 Contractor's pre-qualification
2.7 Evaluation of tenders and selection of contractor
2.8 Contract acceptance
2.9 Conditions of contract
2.10 Responsibility of site engineer
2.11 Supervising work of a contractor
2.12 Site order book
2.13 Procedure to prepare bills
2.14 Measurement book
2.15 Muster roll
2.16 Relation between owner, contractor and consultants

3.0 Familiarization with Construction Equipment **5**

3.1 Equipment for excavation, fill, transportation and compaction
3.2 Aggregate handling and concrete construction equipment
3.3 Equipment for construction of pipes and cassions
3.4 Cranes for lifting materials and parts
3.5 Equipment for tunnel construction
3.6 Equipment for hydraulic construction
3.7 Equipment for highway and pavement construction

4.0 Construction Process **8**

4.1 Site surveying and preparation
4.2 Methods of using construction equipment
4.3 Safety arrangements for using the equipment
4.4 Construction scheduling: network techniques and barcharts
4.5 Use of C.P.M. and PERT for planning, scheduling and controlling of construction works

4.6 Cost analysis and control
4.7 Time-cost trade off

5.0 Construction Planning **5**

5.1 Selection of personnel
5.2 Selection of construction plant and equipment
5.3 Arrangement of facilities and shops for construction
5.4 Procurement procedure for materials
5.5 Materials handling system
5.6 Finance management
5.7 Cash flows and financial accounting

6.0 Regulatory Requirements **3**

6.1 Safety regulations
6.2 Workman's compensation board
6.3 Fire regulations and Insurance
6.4 Environment concerns and protection of the environment
6.5 Building codes and quality control

7.0 Project Maintenance **4**

7.1 Importance of maintenance
7.2 Maintenance types: routine, minor, major, schedules, non-schedules and diagnostic
7.3 Planning and scheduling of maintenance
7.4 Estimating maintenance cost
7.5 Management of maintenance and its financing

8.0 Personnel Management **6**

8.1 Management principles: administration and organisation principles
8.2 Centralization and decentralization
8.3 Supervisory and leadership styles
8.4 Importance of communication
8.5 Information systems for decisions
8.6 Motivating and directing: human elements, evaluation and merit rating
8.7 Personnel selection, testing and training
8.8 Trade unions and relation with management

9.0 Record Keeping **4**

9.1 Importance of record keeping for construction and maintenance
9.2 Control of changes during construction or maintenance
9.3 Importance of receipts in calculating taxes
9.4 Accounting Statements: balance sheets, profit and losses
9.5 Lost data for materials, labour, overheads and other expenses
9.6 Cost ascertainment - cost unit, activity costing and other cost characteristics
9.7 Cost comparisons and checking

Tutorial:

Six assignments and two quizzes

Textbook:

1 "Management - Principles and Practice", M.C. Farland.

2 "Construction Management and Accounts", V.N Vazirani and S.P. Chandola.

3 "Construction Planning and Equipment", Dr. B. Staya Narayan.

COURSES
IN
ELECTRICITY, ELECTRONICS AND THERMODYNAMICS

The main objectives of the course in electrical circuits and machines is to teach the students the basic principles of electricity and their applications to DC and AC circuits. The course also identifies the importance and use of electricity in buildings and other civil engineering projects.

The aim of the course in electronics and instrumentation is to provide the students with the basic knowledge needed to understand the principles used in developing electronic devices and circuits. It also illustrates the importance of using electronic equipment, such as computers, data acquisition systems, etc., in the civil engineering profession.

The course in fundamentals of thermodynamics and heat is intended to provide the students with some basic knowledge regarding the properties of substance, principles of work, heat and energy transfer. In this course, the students are also taught the important laws of thermodynamics and their applications.

ELECTRICAL CIRCUITS AND MACHINES
EG 509 CE

Lecture : 2 **Year : 2**
Laboratory :1.5 **Part : A**
Tutorial : 1

		HOURS
1.0	**Introduction**	**2**
1.1	Role of electricity in modern society	
1.2	Energy sources and productions	
1.3	Generation, transmission and distribution of electrical energy	
1.4	Consumption of electricity	
2.0	**D.C. Circuit Fundamentals**	**2**
2.1	Electric Charge/current	
2.2	Sources of electromotive force (EMF)	
2.3	Resistance, resistivity, temperature coefficient of resistance	
2.4	Ohm's law and its applications	
2.5	Good conductor and insulators	
2.6	Power and energy	
2.7	Series and parallel connections of resistors	
2.8	Kirchoff's laws and their applications	
2.9	Star/delta and delta/star transformation	
2.10	Thevinin's theorem and super-position theorem	
3.0	**Electromechanical Energy**	**2**
3.1	Principles of electromechanical energy conversion	
3.2	Voltage and torque relations	
3.3	Joule's law and mechanical equivalent of heat	
3.4	Electromechanical devices: transducers and actuators, D.C. Rotating machines and A.C. machines	
4.0	**Chemical Effect of Electricity**	**2**
4.1	Faraday's laws of electrolysis and their applications	
4.2	Electroplating	
4.3	Primary and secondary cells	
4.4	Lead-acid accumulators, charging ad discharging	
4.5	Cells in series and in parallel and equivalent EMF	
5.0	**A.C. Circuits**	**4**
5.1	Peak, average and RMS values of sinusoidal voltage and current	
5.2	Phasor representation - resistive, inductive, capacitive circuits, voltage and current waveforms	
5.3	Reactance, impedance and impedance triangle	
5.4	R, L, C, series, parallel, and series and parallel circuits	
5.5	Resonance in series and parallel circuits	
5.6	Power, power factor and reactive power	

5.7 Introduction to three phase system - balanced star, and delta connections
5.8 Relation between line and phase quantities
5.9 Power in balances 3 - phase system

6.0 Transformers **2**

6.1 Principles of action
6.2 EMF equation
6.3 Voltage and current ratios, and voltage regulation
6.4 Efficiency
6.5 Types, construction features and uses

7.0 D.C. Machines **4**

7.1 D.C. Generators: principles of action, EMF equation, methods of excitations, armature reaction and its effects of performance characteristics
7.2 D.C. Motors: principles of operation and back EMF
7.3 Mechanical characteristics: starting, speed control, and uses

8.0 Induction Motors **4**

8.1 Rotating magnetic field - working principle
8.2 Constructional features
8.3 Squirrel, case and slip, and ring types of rotors
8.4 Universal characteristics of induction machine and regime and generation alternator

9.0 Synchronous Machines **4**

9.1 Synchronous speed
9.2 Rotating electromagnet system and its advantages
9.3 EMF equation, armature reaction, parallel operation and synchronization
9.4 Synchronous Mortors: characteristics, V curves, and uses

Laboratories:

Six laboratory exercises will be performed in this course. These are:

(a) Basic electrical measurements of voltage, current and resistance
(b) Verification of Ohm's law in series and parallel connections of resistances and cells
(c) A.C. measurements of power and power factor
(d) Characteristics of D.C. machine
(e) Characteristics of A.C. machine
(f) Synchronization

Tutorial:

Six assignments and two quizzes.

Textbook:

1 "Basic Electrical Engineering", A. Kasatkin and M. Perakalin, MIR Publisher, Moscow, 1970.

2 "Electrical Engineering - An Introduction", Stenve E. Schwarz and William G. Oldham, Holt, Rinehart and Winston Publisher, New York, 1984.

ELECTRONICS AND INSTRUMENTATION
EG 579 EX

Lecture : 3 **Year : 2**
Laboratory :1.5 **Part : B**
Tutorial : 1

HOURS

1.0 Introduction
- 1.1 Importance of electronics in modern society
- 1.2 Description of information transmission by telephone, telex, teleprinter, CCTV, radio, telegraph, facsimile
- 1.3 Global satellite communications
- 1.4 Electronics used in civil engineering

2.0 Introduction to Electronic Components and Circuits
- 2.1 Resistor, capacitors, inductor
- 2.2 Linear and non-linear, circuits
- 2.3 Semi-conductor devices: P type & N type semi-conductors, diodes, BJT, UJT, FET, MOSFET, LED, LCD - their basic characteristics, specialties and used including HW and FW rectification and stabilized power supply
- 2.4 Brief description of integrated circuits (IC)
- 2.5 Optical electronics
- 2.6 Power electronics, SCR & power line communication
- 2.7 Telephone, microphone, speakers, megaphones
- 2.8 Electronic control systems

3.0 Amplifiers and Oscillators
- 3.1 CE, CC and CB amplifiers - their characteristics, specialties and uses
- 3.2 Class A, B, and C and AB amplifiers - their characteristics, specialties and uses
- 3.3 Feedback and its importance
- 3.4 Operational amplifiers (Inverting and non-inverting, integrators and differentiators, summing, filters)
- 3.5 Principle of oscillators
- 3.6 Simple Oscillator circuit

4.0 Introduction to Transmission
- 4.1 Radio frequency spectrum (frequency ranges and their uses)
- 4.2 Modes of radio emissions
- 4.3 Antennas
- 4.4 Types of modulation

5.0 Introduction to Communication Equipment
- 5.1 Transmitter (AM, FM, SSB)
- 5.2 Receivers (AM, FM, SSB)
- 5.3 Transceivers
- 5.4 Mobile communication

5.5 Video communication (CCTV, TV)

6.0 Electronic Instruments and Measurements

6.1 Ammeter, voltmeters, ohmmeters, multimeters, meggers and frequency counters - their applications
6.2 CRT - its application
6.3 Voltage regulators
6.4 Application of X-ray, laser and ultrasonic equipment used in civil engineering

7.0 Transducers

7.1 Primary and secondary transducers and applications
7.2 Analog and digital transducers and applications
7.3 Strain gauges and applications
7.4 Variation of dielectric constant for measurement of liquid level

8.0 Instrumentation

8.1 Measurement of pH values
8.2 Measurement of thermal conductivity
8.3 Measurement of humidity, displacement, velocity and thickness, humidity, displacement, acceleration using electronic instruments
8.4 Distance measuring electronic equipment
8.5 Graphic and X-Y recorders & magnetic tape recorders

9.0 Data Transmission and Telemetry

9.1 Methods of transmission
9.2 General telemetric system (electrical, D.C., current, A.C.)
9.3 Digital telemetry (PCM)
9.4 Computer networking

10.0 Digital Electronics and Computers

10.1 Binary, octal, hexadecimal and BCD systems
10.2 Logic circuits
10.3 Counters, registers, memory circuits
10.4 D to A and A to D, voltage to frequency, voltage to time, R-2R ladders, conversions
10.5 Application of computers in civil engineering

Laboratories:

Five laboratory exercises will be performed in this course. These will be related to :

(a) Equipment familiarization
(b) Diodes and rectification
(c) Transistors
(d) Op-amps and logic circuits
(e) Control circuits
(f) D/A and A/D conversions
(g) Transducers and measurements

References:

1. Basic Radio, Vol. 1-6 by Marvin Tepper
2. Electronic Principles - A. Malvino
3. A Course in Electrical & Electronic Measurements and Instrumentation by A.K. Sawhney
4. Electronics Made Simple by Henery Jacobowytz
5. Electronic Fundamentals and Applications by John D. Ryder
6. Digital Techniques by Gree
7. Integrated Electronics - Milliman and Halkias
8. Foundation Instrumentation by Hanna
9. Experimental Stress Analysis and Motion Measurement by Dover and Adams
10. Digital Electronics and Computers by A. Malvino
11. Electronic Communication System by G. Kennedy
12. Microelectronics Circuits, A.S. Sedra and K.C. Smith, Holt, Reinhard and Winston Inc. New York, 2nd Edition, 1987
13. Foundations of Electrical Engineering, J. R. Cogdell, Prentic Hall, Englewood Cliffs, New Jerser, 1990
14. COMS Analog Circuit Design, P.E. Allen and D.R. Holberg, Holt, Reinhard and Wiston Inc., New York
15. Course Manual, Shrestha J.N. Sharma D.K. Dr. IOE Publication.

FUNDAMENTALS OF THERMODYNAMICS AND HEAT

EG 569 ME

Lecture: 3 **Year: 2**
Laboratory: 1.5 **Part: B**
Tutorial: 1

1. Introduction **2**

1.1. Value of energy to society
1.2. Energy balance approach applications in engineering
1.3. Work and heat transfer
1.4. Macroscopic versus microscopic viewpoint

2. Energy and Energy Transfer **5**

2.1. Concepts and definitions
2.2. Thermodynamic systems and their descriptions
2.3. Equilibrium states and quasi-equilibrium process
2.4. Some common properties: pressure, specific volume and temperature
2.5. Energy and its meaning
2.6. Energy transfer: work, heat transfer and power

3. Properties of Common Substances: **3**

3.1. Simple compressible substance: liquid phase, saturation and phases, quality, superheated vapor and p-v diagram
3.2. Other thermodynamic properties: internal energy, entropy, and specific heats
3.3. Development of property data: graphical data presentation, equation of state and tabular data

4. First Law of Thermodynamics: **5**

4.1. Conversation principles and the first law of thermodynamics
4.2. Control volume formulation: conservation of mass and conservation of energy
4.3. Control volume analysis: steady state analysis and unsteady state analysis
4.4. Control volume applications: steady and unsteady work applications, and steady and unsteady flow applications
4.5. Other statements of the first law

5. Entropy and the Second Law of Thermodynamics: **6**

5.1. Entropy and the second law for an isolated system
5.2. Reversible and irreversible processes
5.3. Temperature and pressure definitions
5.4. Entropy- property and relations
5.5. Control mass and volume formulation
5.6. Isentropic process for an ideal gas or for an incompressible fluid or solid
5.7. Cyclic processes and the carnot cycle

5.8. Temperature measurement

6. Thermodynamic Cycles and Common Energy Systems: 4

6.1. Heat engine cycles
6.2. External heat transfer cycles
6.3. Rankine cycle
6.4. Internal combustion cycles
6.5. Refrigeration, air-conditioning and heat pump cycles

7. Analysis Using the Second Law of Thermodynamics: 6

7.1. Reversible work
7.2. Availability
7.3. Irreversibility
7.4. Energy, Helmholtz function and Gibbs function
7.5. General process comparisons

8. Chemical Reactions and Combustion: 5

8.1. Establishing a common basis for combustion processes
8.2. Standards for the comparison of fuels
8.3. Applications to combustion systems
8.4. Application of the second law to combustion processes
8.5. Applications to real devices: efficiency of combustion devices

9. Introduction to Heat Transfer: 10

9.1. Basic concepts and modes of heat transfer
9.2. The conduction rate equation and heat transfer coefficient
9.3. Condution: insulation, R values and electric analogies; overall coefficient
9.4. Convection, radiation properties for black and grey bodies applications;
9.5. Radiation: radiation properties for black and grey bodies applications; earth-atmosphere system, radiant heating systems

Laboratories:
Six laboratory exercises will be performed in this course. These are:

(a) Measurement of pressure, specific volume and temperature
(b) Experiment on compression and expansion of gases
(c) Experiment on thermal energy conduction
(d) Operation of refrigeration or heat pump
(e) Performance of small I.C. engine
(f) Thermal radiation experiment

Tutorials:
Six assignments and two quizzes.

Textbooks:

1 "Fundamentals of Engineering Thermodynamics", John R., Howell and Richard O. Buckius, McGraw-Hill Publishers, 1987.

URBAN & REGIONAL PLANNING
(Elective)

Lecture : 3 **Year : 4**
Laboratory :1 **Part : B**

HOURS

1.0 Introduction to Urban & Regional Planning 3

1.1 Brief explanation of the concept of urban and regional planning

1.2 Importance of planning in the overall perspective of the growth of human settlements

2.0 Introduction to Human Settlements - Rural and Urban 9

2.1 Importance of t study of human settlements to gain insight into the complexity of the mechanism of planning methodologies

2.2 The classic patterns of growth of human settlements:

- Rectilinear gridiron configuration growth mainly on flat riverside floodlands

- Circular configuration growth, which was essentially a refection of lifestyle of hunters, herdsman and warriors

- Radio-centric configuration growth, which resulted from circular forms growing outward radially, with the wedge-shaped areas between the radials filling in gradually

- Linear configuration growth, which was mainly restricted to sites along the river banks and/or arterial trade routes

2.3 Factors that promoted growth of human settlements: climatic conditions; physical features; resources; the availability of resources, especially valuable resources; location; innovations

2.4 An overview of some historical settlements to understand the interaction of various growth factors

3.0 Traditional Urban Design Rural Spatial Systems in Nepal 7

3.1 Explanation of the morphology of rural settlements and regional spatial system

3.2 Tracing the beginning of traditional urban design in Nepal

3.3 Special emphasis on the urban growth of the three main urban centres of the Kathmandu valley: Kathmandu, Patan and Bhadgoan, explaining how the main urban features have been interwoven into interesting urban forms

3.4 Focus on the Durbar Squares as exemplary historical urban design

4.0 Introduction of Modern Practices in Urban and Regional Planning 10

4.1 An overview of some of the modern practices in urban and regional planning with relevant examples

4.2 Highlighting the complexity of modern practices as related to urban and regional planning by touching on the diverse activity systems
4.3 Explanation of the concept of a comprehensive land use plan that incorporates various land uses
4.4 Relevant introductory exercises to develop a rudimentary ability to formulate land-use plans
4.5 The urban and regional activity systems and their inter and inter-relationships

5.0 Various Essential Features of Urban and Regional Planning 9

5.1 Population studies as relevant to urban and regional planning: population structure, their distribution, growth and movement; population forecast
5.2 Employment patterns: types of employment - basic and non-basic, their impact on the economy, circulation systems to cater to the employment patterns, other services
5.3 Transportation systems: their types ad patterns; regional systems and urban modes; alternative systems; gravity model
5.4 Urban utilities: water supply and drainage, sewerage & sanitation, electricity etc.

6.0 Housing 4

6.1 Explanation of housing within the context of urban and regional planning
6.2 Housing types - private housing, housing for low income group, site and service etc.
6.3 Power issue to address housing problems, affordability, access to land, building codes and housing standards

7.0 Integrated Rural Development & Rural Centers 3

7.1 Rural Development
7.2 Core elements of rural systems
7.3 Evolution of IEDP
7.4 Programme formulation and implementation
  7.4.1 Programme organisation and design
  7.4.2 Decentralization and community participation
7.5 Nepal's development region

Tutorial:

Six assignments.

Textbook:

1 " The Urban Pattern", Arthur B. Gallion & Simon Easirer - City Planning and Design.

2 "Urban Design", Paul D. Spreiragen, The Architecture of Towns and Cities

3 "The Traditional Architecture of Kathmandu Valley", Wolfgang Korn

ELECTIVE AND PROJECT WORK COURSES

Courses in Electives

The aim of the elective subjects is to have an advanced knowledge in given topic or topics within subject areas in which the students may have a special interest.

Two different subjects areas will be offered as Elective I and Elective II.

Each student will be required to follow studies in a selected topic or topics within two subject areas in which he/she may have an special interest. One subject area chosen will fall under Elective I and the other under Elective II.

Courses in Project

The aim of the project is to make the students capable of tackling extensive problems related to Civil Engineering with application of knowledge gained during the whole course.

ELECTIVE I EG 73_CE				ELECTIVE II EG 78_CE			
Lecture : 3	**Year : 4**			**Lecture : 3**	**Year : 4**		
Tutorial : 2	**Part : A**			**Tutorial : 2**	**Part : B**		
Practical : 1				**Practical : 1**			

1. Each student will be required to follow studies in a given topic or topics with in two subject areas in which he/she may have an special interest. One subject area chosen will fall under Elective I and the other under Elective II.

2. Topic will of necessary vary in length and the number of topics which can be covered in any subject area will vary accordingly.

3. To maintain an acceptable student-staff ratio in each optional course of study, depending upon the interest and specialisms of the member staff involved and the facilities available, a limited number only of subject areas and of topics within a subject area would be offered at any time.

4. Topics which have already been covered to some extent earlier in the course could be studied in greater depth while some new topic should be introduced.

PROJECT WORK
EG 777 CE

Practical : 9 **Year : 4**
Part : B

Under the supervision and guidance of a member/members of faculty each student is required to carry out an individual or group project which provides opportunities for tackling problem to Civil Engineering and is required to submit a project report.

The choice of project will depend upon the interests of the student (s), faculty and the facilities available in the campus.

A project may involve:

(a) An experimental investigation,
(b) Preparation of Dissertation involving a literature survey and a correlation of existing knowledge,
(c) Preparation of a design for an extensive Civil Engineering project

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Note:

The project will be conducted under the guidance of the member/members of faculty as they fit beneficial to the students. In 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 own to pursue his work and to consult the faculty whenever any problem crops up. He should then submit a draft report prior to the final report so that the guide can correct gross mistake. The final report should be submitted to the Department Head in duplicate.