Vision of the Institution

To ignite the minds of the students through academic excellence so as to bring about social transformation and prosperity.

Mission of the Institution

- To expand the frontiers of knowledge through Quality Education.
- To provide valued added Research and Development.
- To embody a spirit of excellence in Teaching, Creativity, Scholarship and Outreach.
- To provide a platform for synergy of Academy, Industry and Community.
- To inculcate high standards of Ethical and Professional Behavior.

Vision of CIVIL ENGINEERING Department

To give the nation qualitative Civil Engineers, who can contribute for the construction of a better world with sophisticated infrastructural facilities, eco-friendly houses, modern transportation facilities with a pollution free environment and to protect the precious natural resources of this planet.

Mission of CIVIL ENGINEERING Department

1. To shape the students into good entrepreneurs and to promote self-confidence and all-round development of the student personality through special lectures, practical training programs, field visits and technical seminars.
2. To train the students to acquire generic knowledge in the areas of Civil Engineering
3. To continuously update the physical infrastructure through modernization, thrust area development, R & D and other schemes
4. To generate knowledge base through sustained research and developmental efforts.
5. To produce engineers with self-confidence and overall personality who can be self-employed and generate employment opportunities to fellow engineers and take active part in nation building,
6. Keeping in view the challenges of the future.

Program Educational Objectives (PEOs)

PEO:1

The main objective of the faculty is to guide them by the principles of sustainable development and global inter connectedness with the civil structures, and make them to understand the impact of civil engineering projects how they effects the society and environment in case of failures.

PEO:2

To develop their communication skills(Oral, Written, Visual, Graphic modes) which makes them to participate actively in their communities and profession when working as team leaders or members.

PEO:3

An intensive training is provided to identify, formulate and solving engineering problems in technical areas appropriate CIVIL ENGINEERING.

PEO:4

To make them competent and engaged engineering professionals applying their technical and managerial skills in planning, designing and construction.

Program Outcomes (POs) of CIVIL ENGINEERING Department

Engineering Graduates will be able to:

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

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs) of CIVIL ENGINEERING Department

PSO 1:

An ability to learn constructional concepts and to implement them in the field work and to make the structural planning in a smarter way.

PSO 2:

To encourage young energetic engineers in technical and software skills in the field of Civil Engineering with innovative thoughts along with existing and future trends in constructional field.

PSO 3 :

The capability to integrate knowledge in constructional field work and to improve skills to become an entrepreneur.

Subject	BUILDING MATERIALS AND CONSTRUCTION				
Year/semester	II B.Tech/I Sem	L	T	P	C
Regulation year	2020-2021	3	0	0	3

COURSE OBJECTIVES:

1. Initiating the student with the knowledge of basic building materials and theirproperties.
2. Imparting the knowledge of course pattern in masonry construction and flat roofsand techniques of forming foundation, columns, beams, walls, sloped and flatroofs.
3. The student is to be exposed to the various patterns of floors, walls, different typesof paints and varnishes.
4. Imparting the students with the techniques of formwork and scaffolding.
5. The students should be exposed to classification of aggregates, moisture contentof the aggregate.

UNIT – I

STONES, BRICKS AND TILES

Properties of Building Stones – Relation to Their Structural Requirements. Classification of Stones – Stone Quarrying – Precautions in Blasting, Dressing of Stone, Composition of Good Brick Earth, Various Methods of Manufacturing of Bricks. Characteristics of Good Tile – Manufacturing Methods, Types of Tiles. Use of Materials like Aluminum, Gypsum, Glass and Bituminous Materials – Their Quality.

UNIT-II

MASONARY

Types of Masonry, English and Flemish Bonds, Rubble and Ashlar Masonry, Cavity and Partition Walls.

WOOD: Structure – Properties – Seasoning of Timber. Classification of Various Types of Woods Used In Buildings – Defects in Timber. Alternative Materials for Wood, Galvanized Iron, Fiber-Reinforced Plastics, Steel, Aluminum.

UNIT – III

LIME AND CEMENT

Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime.

Cement: Portland cement – Chemical Composition - hydration, Setting and Fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of Cement concrete and their importance – various tests for concrete.

UNIT-IV

BUILDING COMPONENTS

Lintels, Arches, Vaults - stair cases – Types. Different types of floors-Concrete, Mosaic, Terrazzo floors, pitched, flat Roofs. Lean-to-Roof, Coupled Roofs, Trussed roofs- King and Queen Post Trusses. RCC Roofs, Madras Terrace and pre-fabricated roofs.

UNIT-V

FINISHINGS:

DampProofing and water proofing materials and uses- Plastering, pointing, white washing and distempering

Paints: Constituents of a paint – Types of paints – Painting of new/old Wood – Varnish

Form works and scaffoldings.

UNIT – VI

AGGREGATES

Classification of aggregate – Coarse and fine aggregates – Particle shape and Texture – Bond and strength of Aggregate – Specific gravity – Bulk density, porosity and Absorption – Moisture content of Aggregate – Bulking of sand- Sieve analysis.-Various tests for aggregates

TEXT BOOKS:

TB1: Building Materials, S. S. Bhavikatti, Vices publications House private ltd.

TB2: Building Materials, B. C. Punmia, Laxmi Publications private ltd.

REFERENCES:

R1: Building Materials, S. K. Duggal, New Age International Publications.

R2: Building Materials, P. C. Verghese, PHI learning (P) ltd.

R3: Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. NewDelhi..

R4: Building Materials, Construction and Planning, S. MahaboobBasha, Anuradha Publications, Chennai.

Subject	ENGINEERING GEOLOGY				
Year /semester	II B.Tech/I Sem	L	T	P	C
Regulation year	2020-21	3	0	0	3

Prerequisite: Physics and Chemistry

COURSE OBJECTIVES:

1. To introduce the Engineering Geology as a subject in Civil Engineering.
2. To enable the student to use subject in civil engineering applications.
3. To know the Geological history of India.

SYLLABUS:

UNIT I:

INTRODUCTION: Branches of Geology, Importance of Geology in Civil Engineering with case studies.

Weathering: Weathering of rocks, Geological agents, weathering process of Rock, River process and their development.

UNIT II:

MINERALOGY AND PETROLOGY: Definitions of mineral and rock, Different methods of study of mineral and rock, The study of physical properties of minerals and rocks for megascopic study for the following minerals and rocks, Common rock forming minerals are Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and other ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite And Bauxite. Classification, structures, textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their megascopic study of granite varieties, (pink, gray, green). Pegmatite, Dolerite, Basalt Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate.

UNIT III:

STRUCTURAL GEOLOGY: Strike , Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering.

UNIT IV:

GROUND WATER: Water table, Cone of depression, Geological controls of Ground Water Movement, Ground Water Exploration Techniques.

Earthquakes And Land Slides: Terminology, Classification, causes and effects, Shield areas and Seismic bells, Richter scale intensity, Precautions of building constructions in seismic areas. Classification of Landslides, Causes and Effects, measures to be taken prevent their occurrence at Landslides.

UNIT V:

GEOPHYSICS: Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Radiometric

method and Electrical resistivity, Seismic refraction methods and Engineering properties of rocks.

UNIT VI:

GEOLOGY OF DAMS, RESERVOIRS AND TUNNELS: Types and purpose of Dams, Geological considerations in the selection of a Dam site. Life of Reservoirs Purpose of Tunneling, effects, Lining of Tunnels. Influence of Geology for successful Tunneling.

COURSE OUTCOMES:

1. Identify and classify the geological minerals.
2. Judge the strength & suitability of various rocks for civil engineering use.
3. Identify earthquake prone areas to make necessary hazard mitigation.
4. Prepare, analyze and interpret the Engineering Geologic maps for the ground conditions.
5. Test the geological materials and ground to check the suitability of civil engineering project construction.
6. Do site selection for mega engineering projects like Dams, Tunnels, disposal sites

TEXT BOOKS:

1. 'Engineering Geology' by Subinoy Gangopadhay, Oxford University press.
2. 'Engineering Geology' by D. Venkat Reddy, Vikas Publishing House pvt. Ltd, 2013.
3. 'Engineering Geology' by N. Chenn Kesavulu, Trinity Press (Laxmi Publications), 2nd Edition, 2014.
4. 'Engineering Geology' by Vasudev Kanithi, University Press.

REFERENCES:

1. Engineering Geology for Civil Engineers' by P.C. Varghese,PHI learning pvt. Ltd.
2. 'Geology for Engineers and Environmental Society' by Alan E Kehew, person publications, 3rd edition
3. 'Fundamentals of Engineering Geology' by P.G. Bell, B.S.P. Publications, 2012.
4. 'Engineering Geology' by V.Parthesarathi et al., Wiley Publications
5. 'Environmental Geology' by K.S. Valdiya, McGraw Hill Publications, 2nd ed.

SUBJECT	**SURVEYING AND GEOMATICS**				
YEAR/ SEMESTER	**II B.Tech/ I Sem**	**L**	**T**	**P**	**C**
REGULATION YEAR	**2020-21**	**3**	**-**	**-**	**3**

COURSE LEARNING OBJECTIVES:

To introduce the students to basic principles of surveying, various methods of linear and angles measuring instruments and enable the students to use surveying equipments.

COURSE OBJECTIVES:

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

1. To demonstrate the basic surveying skills
2. To use various surveying instruments.
3. To perform different methods of surveying
4. To compute various data required for various methods of surveying.
5.To integrate the knowledge and produce topographical map.

SYLLABUS:

UNIT-I :

INTRODUCTION TO SURVEYING: definition-Uses of surveying- overview of plane surveying (chain, compass and plane table), Objectives, Principles and classifications – Errors in survey measurements

UNIT-II :

LEVELLING & CONTOURING: Concept and Terminology, Levelling Instruments and their Temporary and permanent adjustments- method of levelling. Characteristics and Uses of contours- methods of conducting contour surveys.

UNIT-III :

THEODOLITE: Description, principles-uses and adjustments – temporary and permanent, measurement of horizontal and vertical angles. Principles of Electronic Theodolite – Introduction to Trigonometrical leveling.

TACHOMETRIC SURVEYING: Stadia and tangential methods of Tacheometry. Distance and Elevation formulae for Staff vertical position.

UNIT-IV :

CURVES: Types of curves, design and setting out – simple and compound curvesIntroduction to geodetic surveying, Total Station and Global positioning system

COMPUTATION OF AREAS AND VOLUMES: Area from field notes, computation of areas along irregular boundaries and area consisting of regular boundaries. Embankments and cutting for a level section and two level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits

UNIT-V :

MODERN FIELD SURVEY SYSTEMS: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Total Station – Parts of a Total Station – Accessories , Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey, Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS.

UNIT-VI :

PHOTOGRAMMETRY SURVEYING: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements , terrestrial photogrammetry, flight planning, Stereoscopy, ground control extension for photographic mapping, aerial

triangulation, radial triangulation, methods; photographic mapping.

TEXT BOOKS:

1. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.
2. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
3. B.C.Punimia, Surveying, Vol-I, II and III, Laxmi Publications.
4. Advance Surveying, Satish Gopi, R. Sathi Kumar and N. Madhu, Pearson Publications.
5. Text book of Surveying, C. Venkataramaiah, University press, India Limited.
6. Surveying and levelling, R. Subramanian, Oxford University press.

REFERENCES:

1. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
2. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
3. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
4. Text book of Surveying, S.K. Duggal (Vol No. 1&2), Tata McGraw Hill Publishing Co. Ltd. New Delhi.
5. Text book of Surveying, Arora (Vol No. 1&2), Standard Book House, Delhi

COURSE OUTCOMES

1. An ability to apply knowledge of mathematics, science, and applied sciences
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to formulate or design a system, process or program to meet desired needs
4. An ability to function on multi-disciplinary teams
5. An ability to identify and solve applied science problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of solutions in a global and societal context

Subject	**ENGINEERING MECHANICS**				
Year /semester	**II B.Tech/I Sem**	**L**	**T**	**P**	**C**
Regulation year	**2020-21**	**3**	**0**	**0**	**3**

Prerequisites:
The student should have knowledge in Mathematics and Physics for solving problems.

COURSE OBJECTIVES:
The students completing this course are expected to

1. Understand the concepts of forces and its resolution in different planes, resultant of force system.
2. Know about forces acting on a body, their free body diagrams using graphical methods.
3. Understand the concepts of centre of gravity and moments of inertia and their application.
4. Have knowledge about different types of motion, friction and application of work - energy method.

SYLLABUS:

UNIT-I :

INTRODUCTION TO ENGINEERING MECHANICS & FORCE SYSTEMS: Introduction to Engineering Mechanics covering, Force Systems Basic concepts, System of Forces, Coplanar Concurrent Forces, Resultant Force, Moment of Forces and its Application, Couples. Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT-II

FRICTION: Friction covering, Types of friction, Limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction, Laws of Friction, Static and Dynamic Friction, Motion of Bodies, ladder friction, wedge friction, screw jack & differential screw jack.

UNIT-III

CENTRIOD: Centroid and Centre of Gravity covering, Centroids of simple figures from first principle Centroid of composite sections Centre of gravity of simple solid bodies from first principle, Centre of gravity of simple body centre of gravity of composite bodies, Pappus theorems.

UNIT-IV

MOMENT OF INERTIA: Area moment of inertia- Definition , Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.
Mass moment Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies inertia of thin solid rod circular plate M.I of Circular ring M.I of Cylinder, Cone, and Sphere

UNIT-V

KINEMATICS & KINETICS: Review of particle Kinematics, Rectilinear motion and Plane curvilinear motion- Velocity and Acceleration –Motion of Rigid Body. **Kinetics** of Rigid Bodies covering Basic terms, general principles in dynamics Types of motion Instantaneous centre of rotation in plane motion and simple problems, Impulse-momentum Kinetics of rigid body rotation.

UNIT-VI

WORK, ENERGY, POWER: Work energy principle, Application in plane motion of connected bodies, Plane motion, impulse momentum method.

COURSE OUTCOMES:

Uponthe successful completion ofthis course, the studentswill be able to:

1. Understand the concepts of force and friction, direction and its application.
2. Know the application of free body diagrams and make solution to problems using graphical methods and law of triangle of forces.
3. Calculate the centroid and centre of gravity.
4. Exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.
5. Exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.
6. Exposed to concepts of work, energy and particle motion

TEXT BOOKS:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. Timoshenko solutions Manual 5^{th} edition – Engineering Mechanics by Timoshenko.
4. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
5. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press

REFERENCES:

1. Shanes and Rao (2006), Engineering Mechanics, Pearson Education
2. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
3. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
4. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
5. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
6. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

Subject	ENGINEERING GEOLOGY LAB				
Year /semester	II B.Tech/I Sem	L	T	P	C
Regulation year	2020-21	0	0	3	1.5

Prerequisite: Knowledge on physics and chemistry is necessary.

LABORATORY OBJECTIVES:

1. To identify the mega-scopic types of Ore minerals & Rock forming minerals and the mega-scopic types of Igneous, Sedimentary, Metamorphic rocks.
2. To identify the topography of the site & material selection

LIST OF EXPERIMENTS:

EXP1: Physical and Engineering properties of minerals: Mega-scopic identification of Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group & Talc,

EXP2: Physical and Engineering properties of minerals: Mega-scopic identification of Rock forming minerals – Chlorite, Olivine, Kyanite, Asbestos, Tourmaline, Calcite, Gypsum.

EXP3: Physical and Engineering properties of minerals: Mega-scopic identification of Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc

EXP4: Megascopic description and identification of Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt

EXP5: Megascopic description and identification of Sedimentary rocks – Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglomerate

EXP6: Megascopic description and identification of Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite &Biotiteschist, Marble, Khondalite.

EXP7: Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities.

EXP8: Simple Structural Geology Problems.

EXP9: Field work – To identify Minerals, Rocks, and Geomorphology & Structural Geology.

EXP10: To identify the minerals and rocks Augite, Hornblende, Bauxite, Galena, Soapstone

LABORATORY OUTCOMES:

CO1: Understand the physical properties of Rocks & Minerals

CO2: Know the occurrence of materials using the strike & Dip problems.

CO3: Capable to draw the sections for geological maps showing faults & unconformities.
CO4: Investigate the site for civil engineering projects

TEXT BOOKS:

1. 'Engineering Geology' by SubinoyGangopadhay, Oxford University press.
2. 'Engineering Geology' by D. Venkat Reddy, Vikas Publishing House pvt. Ltd, 2013.
3. 'Engineering Geology' by N. ChennKesavulu, Trinity Press (Laxmi Publications), 2nd Edition, 2014.
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2. 'Geology for Engineers and Environmental Society' by Alan E Kehew, person publications, 3rd edition
3. 'Fundamentals of Engineering Geology' by P.G. Bell, B.S.P. Publications, 2012.
4. 'Engineering Geology' by V.Parthesarathi et al., Wiley Publications
5. 'Environmental Geology' by K.S. Valdiya, McGraw Hill Publications, 2nd ed

NAME OF THE LAB	**SURVEYING LABORATORY**				
YEAR/ SEMESTER	**II B.Tech/ I Sem**	**L**	**T**	**P**	**C**
REGULATION YEAR	**2020-21**	**-**	**-**	**3**	**1.5**

COURSE OBJECTIVES:

1. Aimed at acquiring practical knowledge of various components of chain Surveying.
2. To understand compass surveying, plane table surveying & levelling.
3. To understand surveying with theodolite.
4. Understand the usage and functions of Total Station & DGPS

LIST OF EXPERIMENTS:

1. Chaining across obstacles and determine its area.
2. Surveying of a given area by prismatic compass (closed traverse) and plotting after adjustment.
3. Radiation method or intersection methods by plane Table survey
4. Two point or three point problems in plane table survey
5. Levelling H.I & Rise & fall
6. Two exercises on contouring.
7. Measurement of horizontal angles by method of Repetition and Reiteration.
8. Trigonometric Levelling - Heights and distance problem.
9. Heights and distance using Principles of tachometric surveying.

10. Curve setting – different methods.
11. Total Station Surveying - Measurements of Distances and Angles, Slope distances, Height, Traversing,
12. DGPS Surveying – Coordinate Measurements.

TEXT BOOKS:

1. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.
2. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
3. B.C.Punimia, Surveying, Vol-I, II and III, Laxmi Publications.

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1. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
2. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001
3. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros,2011

COURSE OUTCOMES:

1. Able to Use handle Linear and angular measurements.
2. Able to draw contour maps.
3. Knowledge on calculating elevations of ground.
4. Familiar in using modern tool.