TUJIANZHUANYE"SHIERWU"GUIHUAJIAOCAI
土建专业"十二五"规划教材

土木工程专业英语

TUMUGONGCHENG ZHUANYE YINGYU

建筑是人们用土、石、木、钢、玻璃、芦苇、塑料等一切可以利用的材料建造的构筑物。建筑的本身不是目的，建筑的目的是获得建筑所形成的"空间"

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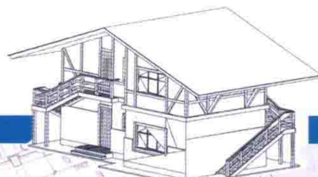

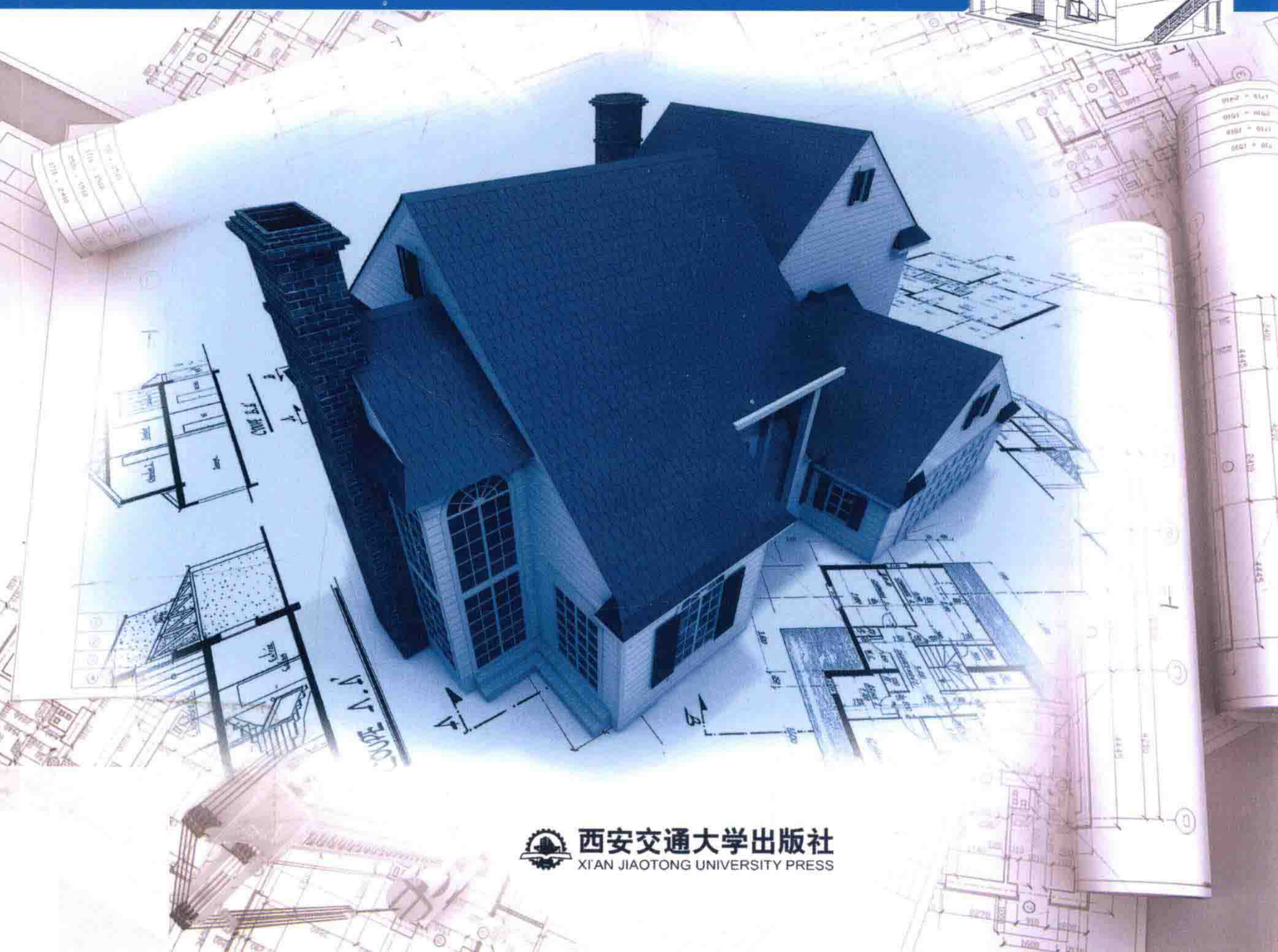

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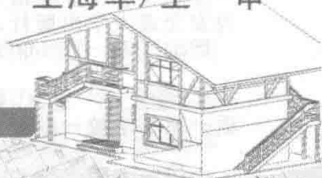

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内容提要

本书是在“大土木、大工程”背景下，满足高等学校土木工程专业培养应用型人才的需要，根据大学英语教学大纲的规定和土木工程专业英语教学的新要求编写而成的。全书由17个单元组成，涵盖土木工程总论、结构工程、岩土工程、道路与桥梁工程、隧道与地下工程、土木工程施工组织与计划、投标文件的编制及开标、土木工程事故分析处理等内容。

本书可作为普通高等院校土木工程专业的本、专科教材，也可作为高等职业技术学院的教学用书，亦可供土木工程及相关领域的工程技术人员阅读参考。

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前　言

为满足高等学校土木工程专业培养应用型人才的需要，我们根据土木工程各专业的特点和土木工程专业英语教学的新要求编写了本教材。

本书基于大土木的专业背景，内容编排上力求覆盖面广、知识面宽。全书由17个单元组成，涵盖土木工程总论、结构工程、岩土工程、道路与桥梁工程、隧道与地下工程、土木工程施工组织与计划、投标文件的编制及开标、土木工程事故分析处理等方面。单元内容的安排上，编排了一篇课文及两篇阅读材料，并配有生词、短语和练习，力求教授和自主学习相结合，在提高学生专业英语的阅读和翻译水平的同时，可以学到土木工程领域的新知识、新成果。为了便于读者学习，本书还增加了附录Ⅰ～Ⅴ，包括：专业英语常用词缀、常用数学符号的文字表达、土木工程中常用的度量衡和单位换算、词汇表以及土木工程常用专业词汇，进一步增强了本教材的实用性。

本书是在编者多年来的教学实践经验的基础上编写而成的，由魏华和梁旭黎主编。编写分工如下：魏华编写1～10单元及附录Ⅰ～Ⅴ；栾宇编写11～13单元；梁旭黎、宁中年、陈金洪编写14单元；高华国编写15～17单元。全书由魏华统编定稿。编写过程中参考了诸多版本的教材及文献资料，武汉理工大学华夏学院王爰瑗、长春建筑学院赵月、石家庄外国语翻译学院李敏提供了资料，在此对所有作者一并深表感谢。

王海军教授对本书进行了全面审阅，就教材内容的编排提出了很多宝贵的意见，在此表示衷心感谢。

由于编者水平有限，书中难免存在不妥之处，恳请读者批评指正。

编　者

2014年10月

目 录

Unit 1 Careers in Civil Engineering

Engineering is a profession, which means that an engineer must have a specialized university education. Many government jurisdictions also have licensing procedures which require engineering graduates to pass an examination, similar to the bar examination for a lawyer, before they can actively start on their careers.

In the university, mathematics, physics, and chemistry are heavily emphasized throughout the engineering curriculum, particularly in the first two or three years. Mathematics is very important in all branches of engineering, so it is greatly stressed. Today, mathematics is included in statistics, which deals with gathering, classifying, and using numerical data, or pieces of information. An important aspect of statistical mathematics is probability, which deals with what may happen when there are different factors, or variable, that can change the results of a problem. Before the construction of a bridge is undertaken, for example, a statistical study is made of the amount of traffic the bridge will be expected to handle. In the design of the bridge, variable such as water pressure on the foundations, impact, the effects of different wind forces, and many other factors must be considered.

Because a great deal of calculations are involved in solving these problems, computer programming is now included in almost all engineering curricula. Computers, of course, can solve many problems involving calculations with greater speed and accuracy than a human being can. But computers are useless unless they are given clear and accurate instructions and information,in other words, a good program.

In spite of the heavy emphasis on technical subjects in the engineering curriculum, a current trend is to require students to take courses in the social sciences and the language arts. The relationship between engineering and society is getting closer; it is sufficient, therefore, to say again that the work performed by an engineer affects society in many different and important ways that he or she should be aware of. An engineer also needs a sufficient command of language to be able to prepare reports that are clear and, in many cases, persuasive. An engineer engaged in research need to be able to write up his or her finding for scientific publications.

In the last two years, an engineering program includes subjects within the student's field of specialization. For the student who is preparing to become a civil engineer, these specialized courses may deal with such subjects as geodetic surveying, soil mechanics, or hydraulics.

Active recruiting for engineers often begins before the student's last year in the university. Many different corporations and government agencies have competed for the services of engineers in recent years. In the science-oriented society, well-trained teachnican, of course, in demand. Young engineers may choose to go into environmental or sanitary engineering, for example, where environmental concerns have created many vacancies; or they may choose construction firms that specialize in highway work; or they may prefer to work with one of the government agencies that deal with water resources. Indeed, the choice is large and varied.

When the young engineer has finally started actual practice, the theoretical knowledge acquired in the university must be applied. He or she will probably be assigned at the beginning to work with a team of engineers. Thus, on-the-job training can be acquitted that will demonstrate his or her ability to translate theory into practice.

The civil engineer may work in research, design, construction supervision, maintenance, or even in sales or management. Each of these areas involves different duties, different emphases, and different uses of the engineer's knowledge and experience.

Research is one of the most important aspects of scientific and engineering practice. A researcher usually works as a member of a team with other scientists and engineers. He or she is often employed in a laboratory that is financed by government or industry. Areas of research concerned with civil engineering included soil mechanics and soil stabilization techniques, and also the development and testing of new structural material.

Civil engineering projects are almost unique; that is, each has its own problems and design features. Therefore, careful study is given to each project even before design work begins. The study includes a survey both of topographical and subsoil feature of the proposed site. It also includes a consideration of possible alternatives, such as a concrete gravity dam or an earth-fill embankment dam. The economic factors involved in each of the possible alternatives must also be weighed. Today, a study usually includes a consideration of the environmental impact of the project. Many engineers, usually working as a team that includes surveyors, specialists in soil mechanics, and experts in design and construction, are involved in making these feasibility studies.

Many civil engineers, among them the top people in the field, work in design. As we have seen, civil engineers work on many different kinds of structures, so it is normal practice for an engineer to specialize in just one kind. In designing buildings, engineers often work as consultants to architectural or construction firms. Dams, bridges, water supply systems, and other large projects ordinarily employ several engineers whose work is coordinated by a systems engineer in charge of the entire project. In many cases, engineers from other disciplines are involved. In a dam project, for example, electrical and mechanical engineers work on the design of powerhouse and its equipment. In other cases, civil engineers are assigned to work on a project in another field; in the space program, for instance, civil engineers were necessary in the design and construction of such structures as launching pads and rocket storage facilities.

Construction is a complicated process on almost all engineering projects. It involves scheduling the work and utilizing the equipment and materials so that cost is kept as low as possible. Safety factors must also be taken into account, since construction can be very dangerous. Many civil engineers therefore specialize in the construction phrase.

Much of the work of civil engineers is carried on outdoors, often in rugged and difficult terrain or under dangerous conditions. Surveying is an outdoor occupation, for example, and dams are often built in wild river valleys or gorges. Bridges, tunnels, and skyscrapers under construction can also be dangerous places to work. In addition, the work must also process under all kinds of weather conditions. The prospective civil engineer should be aware of the physical demands that will be made on him or her.

Vocabularies and Expressions

jurisdiction 权限，管辖权
bar 法庭，律师的职业
curriculum 课程，学习计划
statistic 统计学的，统计表
persuasive 有说服力的；动因，诱因
recruit 补充，招收，招聘
science-oriented 以科学为导向
specialize 专门研究，使专业化
geodetic 大地测量学
hydraulics 水利学
acquit 尽职，赦免
topographical 地形学的
subsoil 下(亚)层土，地基下层土
consultant 顾问，咨询者
powerhouse 动力室，发电厂
rugged 崎岖的，艰难的
terrain 地域，地带
gorge 峡谷
skyscraper 摩天楼
prospective 将来的，未来的
earth-fill embankment dam 填土坝
feasibility study 可行性研究
launching pads 发射台
rocket storage facilities 火箭库
construction phase 施工阶段

Exercises

Ⅰ. Translate the following terms into Chinese.

1. civil engineering
2. engineering graduate
3. engineering curriculum
4. soil mechanics
5. on-the-job
6. structural materials
7. construction phase
8. scientific publication
9. geodetic surveying
10. feasibility study

Ⅱ. Translate the following sentences into Chinese.

1. In the design of the bridge, variable such as water pressure on the foundations, impact, the effects of different wind forces, and many other factors must be considered.
2. The relationship between engineering and society is getting closer; it is sufficient, therefore, to say again that the work performed by an engineer affects society in many different and important ways that he or she should be aware of.
3. The civil engineer may work in research, design, construction supervision, maintenance, or even in sales or management. Each of these areas involves different duties, different emphases, and different uses of the engineer's knowledge and experience.
4. Civil engineering projects are almost unique; that is, each has its own problems and design features. Therefore, careful study is given to each project even before design work begins.
5. Construction is a complicated process on almost all engineering projects. It involves scheduling the work and utilizing the equipment and materials so that cost is kept as low as possible.

Reading Material Ⅰ: Civil Engineering

Civil engineering might be generalized as being the basis of all engineering. In the time of the Romans, engineers were building roads, arch bridges, aqueducts, and cemented structures. Much later, as the inventive Genius of man developed the use of electricity and steam machinery, other forms of engineering came about. At the present time, the civil engineer is concerned with the building of things that do not move. For example, he may specialize in the construction of one or more of the following: bridges, railroad beds, highways, tunnels, office buildings, monuments, airports, railroad stations, dams, canals, water-supply conduits, water-treatment plants, plants for the disposal of refuse and sewerage, hotels, industrial plants, rocket-launching pads, parking garages, transmission-line towers, and radar towers.

Planning of Structures. The principal job of civil engineering is the physical design of structures, For a given structure, such as a bridge; an exhaustive study must first be made of the forces acting on the structure. These are called loads, and may consist of wind load, weight of the parts of the structure itself (dead loads), moving loads such as trains or trucks, snow or rain, and conditions of temperature exposure which may be encountered during the proposed useful life of the structure. A system of structural units such as beams, girders, and columns must be devised to resist these forces.

In this connection, the civil engineer must investigate the materials available to resist these forces. Materials widely used are steel, concrete, stone, brick, and combinations of materials, such as reinforced concrete. Furthermore, new materials, such as plastics, are constantly being developed. The final appearance of the structure is important and determines the use of an ornamental material such as marble. The finished structure must also be resistant to corrosion, and various paints and surface treatment are used by the civil engineering. In this process he is helped by the architect, who is concerned with the appearance of the building and its successful functioning—such as enabling crowds of people to move through a railroad station or in an office building.

Traffic and Highway Construction. The civil engineer is concerned with providing optimum conditions for the efficient flow of traffic in a metropolitan area. Well in advance of design and construction, a master plan of the city must be prepared, laying out throughways, parkways, and parking facilities. Access must be provided for business concerns and stores. This represents the work of the traffic and highway engineer. He must establish by count the probable member of automobiles going and coming to urban and city areas. The number that can be stored in a given space must be determined before a parking garage can be designed. In addition, bridges and runnels must be designed to carry the traffic over and under both natural and man-made obstacles.

Sanitation. The civil engineering is concerned with furnishing us with a supply of drinking water and removing sanitary wastes. Sources for surface water must be sought in the highlands, where dams are designed and reservoirs set up to store the rain water. The civil engineering must see that the dams are watertight and strong enough to hold back the pressure of the water. The rain is caught in special buckets and kept track of by weight and time. These records are analyzed to determine how much water will be available for a given period of time. Also the frequency of occurrence of intense storms is analyzed to determine the maximum floods that might occur and wipe out the dam.

One growing problem of the civil engineering is in the disposal of waste products. In the early days, sewage and industrial waste products were readily dumped into the nearest river or buried. Now the large increase of population, both in the cities and along the rivers, has forced the engineers to determine effective means of alleviating the pollution of the waters.

The engineer must lay out a system of pipes, usually made of vitrified clay, to carry the waste products by liquid flow to a central plant. The system usually flows by gravity with occasional pumping when necessary. Provision must be made for gases that may collect in the top of the pipes. At the plant the impurities are settled out and the liquid wastes are treated by various methods to render them harmless for disposal in the receiving waters. The solids removed must be disposed of by burial on land or at sea. In recent years the increasing quantity of radioactive wastes is giving the civil engineer some difficult problems to solve.

In the case of many rivers and lakes, fresh water of various degrees of pollution must be drawn out and purified for use as drinking water. The engineer must provide processes whereby the solid particles are filtered out and the water is sterilized usually by means of chlorine compounds. The water must be delivered to consumers by a system of pipes at suitable pressure to reach top stories of buildings. Quantities of water must be stored and be available to put out fires and to provide a supply during emergencies.

Flood Control and Electric Power Generation. For this aspect of his work, which is not unrelated to the foregoing, the civil engineer must plan a series of dams to develop water power along a river as well as hydroelectric and steam-generating power plants. Also, certain rivers are made navigable by water stored in reservoirs and fed into canal locks. The famous Erie Canal system is a local illustration. When storms come up, the reservoir's elevation must be drawn down to provide room for the flood and reduce its damage. This is called flood control and is one phase of a four-way river development plan—water supply, navigation, flood control, and hydroelectric power. In planning the projects the civil engineer must consider other factors, such as disturbance of fish life or of wild fowl and hunting areas.

In all of these projects, carried out by the civil engineer, the associated financial problems must first be considered. The community's need for the project must be demonstrated, and the most economical way of carrying it out determined. Then money for the project can be raised by government units or financiers.

In addition to planning, and directing the construction of projects, civil engineers frequently operate bureaus of public works and power plants. Many civil engineers are engaged by the federal, state, and local governments in connection with public-works projects.

Reading Material II: Civil Engineering

Civil engineering, the oldest of the engineering specialties, is the planning, design, construction, and management of the built environment. This environment includes all structures built according to scientific principles, from irrigation and drainage systems to rocket-launching facilities.

Civil engineers build roads, bridges, tunnels, dams, harbors, power plants, water and sewage systems, hospitals, schools, mass transit, and other public facilities essential to modern society and large population concentrations. They also build privately owned facilities such as airports, railroads, pipelines, skyscrapers, and other large structures designed for industrial, commercial, or residential use. In addition, civil engineers plan, design, and build complete cities and towns, and more recently have been planning and designing space platforms to house self-contained communities.

The word civil derives from the Latin for citizen. In 1782, Englishman John Smeaton used the term to differentiate his nonmilitary engineering work from that of the military engineers who predominated at the time. Since then, the term civil engineering has often been used to refer to engineers who build public facilities, although the field is much broader.

Scope. Because it is so broad, civil engineering is subdivided into a number of technical specialties. Depending on the type of project, the skills of many kinds of civil engineer specialists may be needed. When a project begins, the site is surveyed and mapped by civil engineers who locate utility placement-water, sewer, and power lines. Geotechnical specialists perform soil experiments to determine if the earth can bear the weight of the project. Environmental specialists study the project's impact on the local area: the potential for air and groundwater pollution, the project's impact on local animal and plant life, and how the project can be designed to meet government requirements aimed at protecting the environment. Transportation specialists determine what kinds of facilities are needed to ease the burden on local roads and other transportation networks that will result from the completed project. Meanwhile, structural specialists use preliminary data to make detailed designs, plans, and specifications for the project. Supervising and coordinating the work of these civil engineer specialists, from beginning to end of the project, are the construction management specialists. Based on information supplied by the other specialists, construction management civil engineers estimate quantities and costs of materials and labor, schedule all work, order materials and equipment for the job, hire contractors and subcontractors, and perform other supervisory work to ensure the project is completed on time and as specified.

Throughout any given project, civil engineers make extensive use of computers. Computers are used to design the project's various elements (computer-aided design, or CAD) and to manage it. Computers are a necessity for the modern civil engineer because they permit the engineer to efficiently handle the large quantities of data needed in determining the best way to construct a project.

Structural engineering. In this speciality, civil engineers plan and design structures of all types, including bridges, dams, power plants, supports for equipment, special structures for offshore projects, the United States space program, transmission towers, giant astronomical radio telescopes, and many other kinds of projects. Using computers, structural engineers determine the forces a structure must resist: its own weight, wind and hurricane forces, temperature changes that expand or contract construction materials, and earthquakes. They also determine the combination of appropriate materials: steel, concrete, plastic, stone, asphalt, brick, aluminum, or other construction materials.

Water resources engineering. Civil engineers in this specialty deal with all aspects of the physical control of water. Their projects help prevent floods, supply water for cities and for irrigation, manage and control rivers and water runoff, and maintain beaches and other waterfront facilities. In addition, they design and maintain harbors, canals, and locks, build huge hydroelectric dams and smaller dams and water impoundments of all kinds, help design offshore structures, and determine the location of structures affecting navigation.

Geotechnical engineering. Civil engineers who specialize in this field analyze the properties of soils and rocks that support structures and affect structural behavior. They evaluate and work to minimize the potential settlement of buildings and other structures that stems from the pressure of their weight on the earth. These engineers also evaluate and determine how to strengthen the stability of slopes and fills and how to protect structures against earthquakes and the effects of groundwater.

Environmental engineering. In this branch of engineering, civil engineers design, build, and supervise systems to provide safe drinking water and to prevent and control pollution of water supplies, both on the surface and underground. They also design, build, and supervise projects to control or eliminate pollution of the land and air. These engineers build water and wastewater treatment plants, and design air scrubbers and other devices to minimize or eliminate air pollution caused by industrial processes, incineration, or other smoke-producing activities. They also work to control toxic and hazardous wastes through the construction of special dump sites or the neutralizing of toxic and hazardous substances. In addition, the engineers design and manage sanitary landfills to prevent pollution of surrounding land.

Transportation engineering. Civil engineers working in this specialty build facilities to ensure safe and efficient movement of both people and goods. They specialize in designing and maintaining all types of transportation facilities, highways and streets, mass transit systems, railroads and airfields, ports and harbors. Transportation engineers apply technological knowledge as well as consideration of the economic, political, and social factors in designing each project. They work closely with urban planners, since the quality of the community is directly related to the quality of the transportation system.

Pipeline engineering. In this branch of civil engineering, engineers build pipelines and related facilities which transport liquids, gases, or solids ranging from coal slurries (mixed coal and water) and semi-liquid wastes, to water, oil, and various types of highly combustible and noncombustible gases. The engineers determine pipeline design, the economic and environmental impact of a project on regions it must traverse, the type of materials to be used-steel, concrete, plastic, or combinations of various materials-installation techniques, methods for testing pipeline strength, and controls for maintaining proper pressure and rate of flow of materials being transported. When hazardous materials are being carried, safety is a major consideration as well.

Construction engineering. Civil engineers in this field oversee the construction of a project from beginning to end. Sometimes called project engineers, they apply both technical and managerial skills, including knowledge of construction methods, planning, organizing, financing, and operating construction projects. They coordinate the activities of virtually everyone engaged in the work: the surveyors; workers who lay out and construct the temporary roads and ramps, excavate for the foundation, build the forms and our the concrete; and workers who build the steel framework. These engineers also make regular progress reports to the owners of the structure.

Community and urban planning. Those engaged in this area of civil engineering may plan and develop communities within a city, or entire cities. Such planning involves far more than engineering consideration. Environmental, social, and economic factors in the use and development of land and natural resources are also key elements. These civil engineers coordinate planning of public works along with private development. They evaluate the kinds of facilities needed, including streets and highways, public transportation systems, airports, port facilities, water-supply and wastewater-disposal systems, public buildings, parks, and recreational and other facilities to ensure social and economic as well as environmental well-being.

Photogrametry, surveying, and mapping. The civil engineers in this specialty precisely measure the Earth's surface to obtain reliable information for locating and designing engineering projects. This practice often involves high-technology methods such as satellite and aerial surveying, and computer-processing of photographic imagery. Radio signals from satellites, scans by laser and sonic beams, are converted to maps to provide far more accurate measurements for boring tunnels, building highways and dams, plotting flood control and irrigation projects, locating subsurface geologic formations that may affect a construction project, and a host of other building uses.

Other specialties. Two additional civil engineering specialties that are not entirely within the scope of civil engineering but are essential to the discipline are engineering management and engineering teaching.

Engineering management. Many civil engineers choose careers that eventually lead to management. Others are able to start their careers in management positions. The civil engineer-manager combines technical knowledge with an ability to organize and coordinate worker power, materials, machinery, and money. These engineers may work in government-municipal, county, state, or federal; in the U. S. Army Corps of Engineers as military or civilian management engineers; or in semiautonomous regional or city authorities or similar organizations. They may also manage private engineering firms ranging in size from a few employees to hundreds.

Engineering teaching. The civil engineer who chooses a teaching career usually teaches both graduate and undergraduate students in technical specialties. Many teaching civil engineers engage in basic research that eventually leads to technical innovations in construction materials and methods. Many also serve as consultants on engineering projects, or on technical boards and commissions associated with major projects.

Unit 2 Load Classification

The primary objective of a course in mechanics of materials is the development of relationships between the loads applied to a non-rigid body and the internal forces and deformations induced in the body. Ever since the time of Galileo Galilei (1564-1642), men of scientific bent have studied the problem of the load-carrying capacity of structural members and machine components, and have developed mathematical and experimental methods of analysis for determining the internal forces and the deformations induced by the applied loads. The experiences and observations of these scientists and engineers of the last three centuries are the heritage of the engineer of today. The fundamental knowledge gained over the last three centuries, together with the theories and analysis techniques developed, permit the modern engineer to design, with complete competence and assurance, structures and machines of unprecedented size and complexity.

It will frequently be found that the equations of equilibrium (or motion) are not sufficient to determine all the unknown loads or reactions acting on a body. In such cases it is necessary to consider the geometry (the change in size or shape) of the body after the loads are applied. The deformation per unit length in any direction or dimension is called strain. In some instances, the specified maximum deformation and not the specified maximum stress will govern the maximum load that a member may carry.

Certain terms are commonlyused to describe applied loads; their definitions are given here so that the terminology will be clearly understood.

Loads consist of: (1) concentrated and distributed forces (direct actions), (2) imposed deformations (indirect actions).

A load is assumed as a concentrated load if it is not related to any other load or imposed deformation acting on the structure. In practice more than one single load acts on the structure, although it is convenient to consider each load separately.

Loads are random processes; more precisely, they are stochastic processes. However, in order to match the requirements of the methods of calculation actually used in most structural specifications (allowable stresses and semi-probabilistic methods), each load is also characterized by the parameters representative of the different computational methods.

The loads can be classified with respect to their effect on the structure (static or dynamic) or with respect to their variation of intensity. Loads can also be classified with respect to some particular aspect, such as limited or not limited, having long or short duration, dependent or not on human activities etc.

1. Classification of loads with respect to the structural response

A distinction is made between two types of load according to the response of the struc-