International Course on Aseismic Design and Construction

CADAC/2007

27 August - 9 November 2007

ABOUT CADAC COURSE

Within the framework of the Agreement for Scientific and Technological Cooperation signed between former Yugoslavia and the Royal Netherlands in the second half of the seventies of the last century, an intensive twelve week course for training of engineers in the field of earthquake engineering was proposed by the Institute for Earthquake Engineering and Engineering Seismology, IZIIS, Skopje. The programme was accepted in 1981 and the first course was realized in 1982.

The International Course on Aseismic Design And Construction (CADAC) is the most remarkable and worldwide recognized effort of IZIIS in the field of education and training of young academics and professionals from developing countries. Over the last 25 years, CADAC has trained 491 participants from 73 developing countries from 4 continents. CADAC participants represent a worldwide spread network of missionaries contributing to the seismic safety and welfare of their countries.

As in the years before, 18 fellowships for engineers from developing countries have been provided for this year CADAC 2007 Course through the Ministry of Foreign Affairs, The Hague, Royal Netherlands.

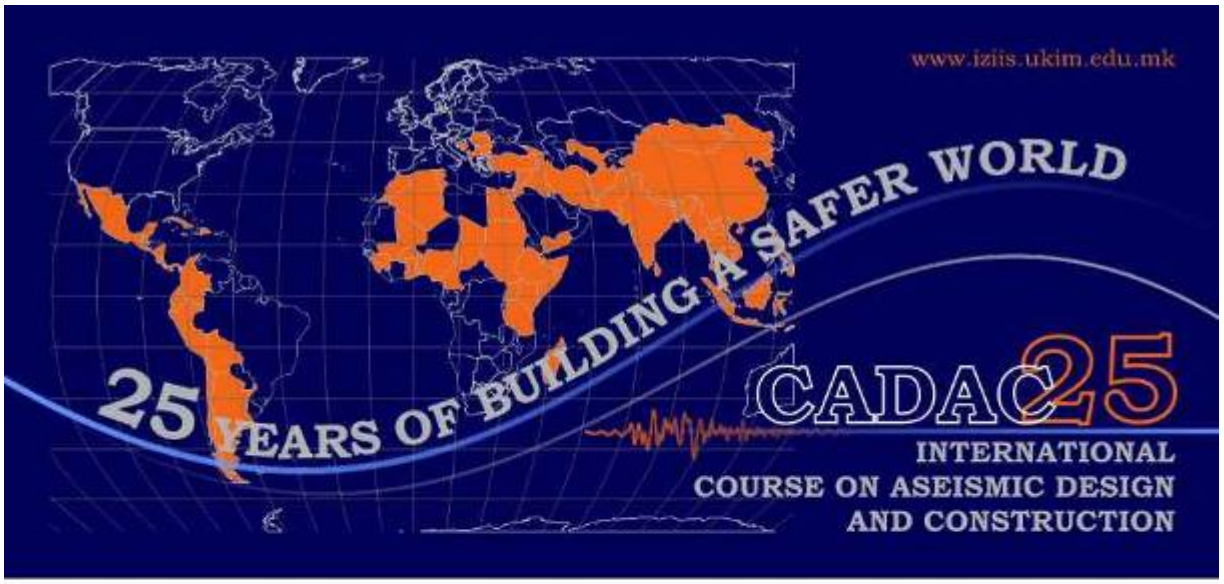
This year additional 12 fellowships for engineers from West Balkan, (Albania, Bosnia and Herzegovina, Croatia, Macedonia, Montenegro, Serbia and UNMIK Kosovo), have also been provided through the Council of Europe Development Bank (from the Trust Account fed by Norway)

MARKING OF 25th ANNIVERSARY OF CADAC COURSE

In the course of 2006, on the occasion of the 25th anniversary of the CADAC Course, our Institute carried out special activities to mark the event and further promote the Course.

Based on an agreement concluded with the Bureau for Philately of Republic of Macedonia, a special seal was issued on the occasion of the 25th anniversary of the CADAC Course. The promotion of the seal took place in the IZIIS' premises on 17th July 2006. The event was held in the presence of the ambassador of the Royal Netherlands - Ms. Frederique De Man, the CADAC Course management and a lot of representatives of the media in R. Macedonia.

After previous announcement through the national media, this seal was affixed on all the shipments from R. Macedonia that were sent on 17 July 2006. Also, a special anniversary post card prepared at the Institute was sent to all the Institute's friends worldwide. This card has a special philatelic value because of the affixed seal.



"..We got used to seeing people die due to earthquakes. It is high time that they learn how to stay alive...."

Furnio D'Alba (UNESCO)

Dear Messrs.,

In 2006, the Institute of Earthquake Engineering and Engineering Seismology, IZIIS, University "Ss Cyril and Methodius", Skopje, Republic of Macedonia is marking the 25th anniversary of organization of the International Course on Aseismic Design and Construction - CADAC. The Course has financially been supported by the International Education Department, Ministry of Foreign Affairs of the Royal Netherlands and the Ministry of Science of Republic of Macedonia. Financial support has also been provided by the Institute of Earthquake Engineering and Engineering Seismology to cover part of the expenses for the CADAC courses.

Due to the long tradition of 25 years, this Course has acquired a world wide reputation which is evident from the great number (490) of participants from 70 countries from 4 continents that have so far attended the Course. We can consider this course as a modest contribution of the ***Governments of the Royal Netherlands*** *and Republic of Macedonia towards seismic risk reduction in earthquake-prone areas in the developing countries.*

On the occasion of the 25th anniversary of the CADAC Course, the Bureau for Philately of Republic of Macedonia has promoted a special seal, which has been affixed on all the shipments from Republic of Macedonia, including this card as well.

It is therefore my special honour to send you this card of a special philatelic value as a token of gratitude for having you among the oldest friends of IZIIS, the city of Skopje and Republic of Macedonia.

Prof. Dr. Mihail GAREVSKI
Director of IZIIS

OBJECTIVES OF THE COURSE

Severe earthquakes and their aftermaths are one of the most frightening and destructive phenomena. Unfortunately, strong earthquakes occurred, occur and will occur in future (one earthquake per annum on the average in the world). On December 26, 2004, a severe earthquake occurred 250 km southwest of Banda Aceh in northern Sumatra, Indonesia. With a moment magnitude exceeding 9.0, it was the second largest instrumentally recorded earthquake in history. The earthquake generated massive tsunami that caused more casualties than any other in recorded history. In total, over 280 000 people were killed along the Asian and African coastlines. Millions more remained homeless.

The recent earthquakes in India, Afghanistan, Northern Algeria, Iran, Pakistan and particularly Sumatra have again emphasized the fact that major loss of life in earthquakes happens when the event occurs in developing countries and affects these types of buildings. Even in the case of relatively moderate earthquakes, in areas with poor housing, many people are killed by the collapse of brittle heavy unreinforced masonry or poorly constructed concrete buildings. The economic loss that may occur as a result of catastrophic earthquakes in underdeveloped countries may cause a complete collapse of their economies.

In the Hyogo Declaration adopted at the World Conference of Disaster Reduction held in Kobe, Japan in the period 18 to 22 January 2005, there is a statement by which: *"there is an urgent need to enhance the capacity of disaster-prone developing countries in particular, the least developed countries and small island developing States, to reduce the impact of disasters, through strengthened national efforts and enhanced bilateral, regional and international cooperation, including through technical and financial assistance".* Also, in the documents of this Conference, especially in the Hyogo Framework for Action 2005-2015, a strong support has been given to providing education, training and transfer of knowledge to professional staff from countries which need the most this type of assistance.

The continuous education of the engineering staff from the underdeveloped countries is of a particular importance for reduction of human and economic loss. Such an education is of a particular importance having in mind the fact that even the cheapest structure can be safe if the basic principles of aseismic design are known and respected. In the programme of this kind of education, it is particularly important to emphasize that all the phases of analysis, design up to consistent construction of what has been planned with the project must be respected.

The main objective of the Course has been and is transfer of knowledge in the field of earthquake engineering to the junior university teaching staff of the developing countries. Due to the fact that earthquake engineering is a rather recent scientific discipline developed in the past decades, all countries should make considerable efforts toward training of staff in this particular discipline. In the efforts for prevention and mitigation of earthquake consequences, engineers play a significant role; they are responsible for developing technical regulations for design and construction of aseismic structures and for provision of conditions for their practical application.

The emphasis in this Course has been put on methods for design and analysis of structures constructed of different materials resistant to earthquake inputs. Therefore, in addition to the junior teaching staff, the programme of the Course is also intended for civil engineers working on design, inspection of construction and development of construction technologies. Having in mind that the presented philosophy for aseismic design of structures is a state-of-the-art of the knowledge which is used in the world, this Course may also serve for refreshing and updating the knowledge of the younger staff of engineering colleges and faculties. In addition, the choice of subjects has been adopted to comply to the identified needs of developing countries.

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ORGANIZATION OF CADAC COURSE

- **Host institution**

The course is held and organized by the Institute for Earthquake Engineering and Engineering Seismology (IZIIS), University "Ss. Cyril and Methodius " in Skopje, Republic of Macedonia. IZIIS is an internationally well-known institution in the field. It was established in 1965 within the University "Ss. Cyril and Methodius" in Skopje, Republic of Macedonia, to organize research and education primarily focused on earthquake engineering and engineering seismology. In following these tasks, the Institute received support from the UN and its specialized agencies UNDP and UNESCO during many years following the disastrous Skopje earthquake of July 26, 1963. While meeting the immediate needs for reconstruction of the city, the Institute created conditions for permanent progress in research, education and training

At present, the IZIIS' main fields of activity are the following: (i) Research, development, education and training in the field of earthquake engineering and engineering seismology; (ii) Assistance (to Governments) in mitigating the consequences of earthquakes and post-disaster recovery; (iii) Development and improvement of technical regulations, standards and codes; (iv) Laboratory and field testing for defining the technical base of earthquake risk reduction; (v)

Seismic monitoring and disaster forecasting; (vi) Promotion of a risk prevention culture, general public and community awareness, participation and publications.

The Institute is furthermore the seat of the "European Centre for Vulnerability of Industrial and Lifeline Systems" and of the "Civil Engineering Committee for Euro region: Nish - Sofia - Skopje".

- **The participants and admission requirements**

The programme for the CADAC/2007 anticipates a total of 30 candidates, i.e. 15 candidates in each group. Applicants should have a degree in civil or architectural engineering - structural division and should be engaged in their countries in design, construction and inspection of structural design and construction. Of course, sometimes a candidate which is a professional in a related field (geologist, architect and alike) could be selected in the process of selection if his/her experience or working position benefits from this course. Preferably, they should have some practice in related jobs, and they should not be over 40 years of age.

- **Application forms**

All candidates must submit the following documents:

1. **Application form, obtained from the Institute of Earthquake Engineering and Engineering Seismology, correctly filled in, and the following attachments:**
2. **Photocopy or typed copy of the certificate of bachelor's degree diploma with a translation into French or English, duly certified by the competent national governmental authorities;**
3. **Copy of the passport;**
4. **Medical certificate;**
5. **Certificate of proficiency in English;**
6. **Other higher education level diplomas or specialized courses certificates, if any.**

The application should be submitted to the Institute for Earthquake Engineering and Engineering Seismology so that it can reach the organizers not later than June 10.

Selection of the candidates is made by representatives of the Scientific Council of the IZIIS. When selecting candidates, professional qualifications, experience, present employment, proficiency in English and good health are taken into consideration

Selected applicants will be notified by the Institute for Earthquake Engineering and Engineering Seismology, University "Ss. Cyril and Mrthodius:, Skopje by June 25.

In addition to the classical mode of filling out of an application (form), there is a possibility for application of candidates through the Internet. The institute is opening a special WebPage containing detailed information on the Course. This WebPage shall give the opportunity to the candidates to electronically fill out the form. *Parallel to the applications through the web site, the applicants should mail the required documentation (certificate of bachelor's degree diploma with translation into French or English, Medical certificate, Certificate of proficiency in English)*

- **Fellowships**

For all selected applicants from developing countries as well from West Balkan, fellowships are available. The fellowship covers the cost of a return air-ticket, travel expenses in Republic of Macedonia, primary health insurance, accommodation and full board as well as some pocket money, 10% of the UN-rate for Macedonia, to cover the most essential personal needs. Free sets of lecture notes; textbooks and other teaching materials are also provided to course participants. *The travel expenses to and from Skopje are not covered for the candidates from West Balkan*

The participant's government or employer is required to bear the following expenses:

1. **All expenses in the home country incidental to travel abroad, including expenditures for passport, visa, medical examinations, inoculation, and other miscellaneous items as well as internal travel to and from the airport of departure in the home country; and**
2. **Salary and other benefits for the participants during the course.**

Neither the Institute nor the host authorities will assume any responsibility for the following expenditures related to the participant's attendance of the course:

1. **Compensation in case of death, disability or illness;**
2. **Loss of, or damage to personal property; and**
3. **Purchase of personal belongings and compensation for damage caused to them by climatic or other conditions.**

Participants are not supposed to be joined by their families during the course. Exceptions can be made only by prior agreement with the management.

- **Duration of the Course**

The duration of the CADAC/2007 course will be 11 weeks, and will be held in the period 27 August - 9 November 2007.

In accordance with the experience gathered from the previous years and the usual requirements of the participants, the lectures are planned to be given from 8:30 to 13:30. After a break of two hours for lunch, continuation of lectures, as well as discussions, seminars, practicals and other activities are organized on maters of individual interest of the participants from 15:30 to 17:30.

The lectures are covered by professors and experts from the Institute for Earthquake Engineering and Engineering Seismology at the University of Skopje. However, as each year before, the lecturing process in the next years will also involve visiting professors who will present their recent investigations and achievements in the field of earthquake engineering.

Practicals in laboratories and visits to construction sites are assisted by experienced engineers who also demonstrate methods of measurement and construction technology. Computer practice on selected problems is included in the programme.

Course participants also visit design offices and construction companies and construction sites in Skopje and the neighboring towns.

- **Management of the Course**

The Course Management consists of:

- Course Coordinator

- One senior and two junior research assistants for matters arising from everyday activities

- Secretary.

The course coordinator is responsible for overall coordination of the organization and implementation of the course. The senior assistant is involved in all aspects of the course (preparation, teaching, organization of field trips, assistance to all the participants etc.), while two junior assistants are appointed to assist Major A and Major B students, respectively.

The members of the Course Management are permanently in contact with the participants for resolving various matters related to the Course, including accommodation and living conditions, administrative issues, etc.

- **Facilities of the Institute**

Since the beginning of the Course, the facilities available for the participants have not been changed. Depending of their interest, the participants can study at the Institute's laboratories and use the computer systems as well as the Institute's library. This year, 20 personal computers with Internet connection will be permanently available to the Course participants. In addition, we hope that all the participants will have personal computers and Internet access in their hotel rooms as well.

- **Additional Information**

Further information is available at request from:

Institute of Earthquake Engineering and Engineering Seismology,
University "Ss. Cyril and Methodius",

73, Salvador Aljende Street, P.O. Box 101
1000 Skopje, Republic of Macedonia

Fax: (+389 2) 3112-163

Phones: (+389 2) 3107-700; (+389 2) 3107-701

http://www.iziis.ukim.edu.mk

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E mail: institut@pluto.iziis.ukim.edu.mk

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PROGRAMME

The present program of the Course is aimed at meeting the needs for design and construction of seismically resistant buildings. These needs are the main concern of countries in earthquake-prone regions. Other important needs are those related to design and construction of seismically resistant civil engineering structures. These arise from the increasing construction of industrial, energy, communication and other infrastructure facilities and life-line systems in developing countries. As each year before, the latest achievements from scientific-research projects realized in IZIIS and experience in the field of occurred earthquakes will be implemented in the corresponding subjects within this year Course programme.

The program of the Course consists of lectures, laboratory and computer practical and other drills. In addition, consultation with professors, individual study and examinations in individual subjects, for which the participants are particularly interested, are foreseen. The total number of lecture hours is about 275, out of which, about 30% are practicals. Additional 30 hours are planned for visiting professors lectures, special lectures and participant presentations.

The official language is English.

The Programme of the Course is selected to meet the needs of improving the knowledge of structural engineers with an emphasis on building and civil engineering structures, namely:

- **A. Aseismic Design of Buildings**
- **B. Aseismic Design of Engineering Structures.**

Hence, the applicants are required to indicate the major that they are interested in. The Programme of the Course anticipates: common subjects in both fields; specific subjects in each of these fields, practicals and optional subjects.

I. Common subjects:

Dynamics of Structures;
Engineering Seismology;
Soil and Foundation Dynamics;
Experimental Mechanics of Structures;
Practical Structural Analysis and Computer Applications;
Management of Disaster Risks
Planning of Seismic Risk Reduction;
Earthquake Codes
Contemporary Natural and Man-Made Disasters

II. Specific subjects:

A. Building Structures:

Design and Construction of Earthquake Resistant Buildings;
Reinforced Concrete Structures;
Prestressed Structures;
Steel Structures;
Masonry Structures;
Repair and Strengthening of Buildings

B. Engineering Structures:

Aseismic Design of Industrial Buildings;
Aseismic Design of Bridges;
Aseismic Design of Dams;
Aseismic Design of Life-Line Structures
Repair and Strengthening of Structures.

III. Practicals

IV. Optional subjects:

Environmental Engineering
Computer, Computer Practice and Numerical Analysis

Brief Description of Subjects

I. Common subjects:

Dynamics of Structures -Introduction to dynamics of structures; linear response of SDOF systems: undamped, damped, forced vibration, response to general dynamic loading. Linear response of MDOF systems. The multistorey shear buildings: free, forced, damped vibrations. Nonlinear response of SDOF systems. Nonlinear response of MDOF systems.
Engineering Seismology -Seismological and tectonic processes causing earthquake occurrence. Earthquake parameters. Seismic effect parameters. Regional seismic effects. Seismological mathematical models. Local soil effects. Geotechnical and geophysical investigations. Soil models. Response spectra. Seismic hazard analysis. Seismic zoning and microzoning. Seismic risk. Seismic design parameters.
Soil and Foundation Dynamics -Dynamic properties of soils and their determination. Response of soil media to earthquake ground motions. Dynamic instabilities of soils: causes of soil failure during earthquakes, soil liquefaction, soil settlement, landslides and slope instability. Foundation vibration: vertical, torsional and simultaneous translational and rocking vibration of non-embedded and embedded foundations. Soil-structure interaction effects: model formulation, dynamic properties and response analysis of structures, experimental full-scale testing for determination of soil-structure interaction effects. Practical considerations in design and construction practice.
Experimental Mechanics of Structures -Introduction to experimental mechanics in earthquake engineering. Dimensional analysis and similarity criteria. Linear and nonlinear dynamic models. Shaking tables. Simulation and control of earthquake motion. Collection of data and analysis. Transducers. Quasi-static test of joints, elements and assemblages. Philosophy and principles of testing. Equipment for testing and measurements. Collected data and analysis. Full-scale test of structures. Resonant method. Ambient vibration technique. Equipment for simulation of motion, measurement and analysis. Identified quantities.
Practical Structural Analysis and Computer Applications -Theoretical basis of practical computer-oriented structural analysis methods. Matrix analysis approach. Design of earthquake resistant structures. Using of simplified mathematical models for static and dynamic analysis of structures. Development of computer programmes. Computer applications for the solution of practical static and dynamic structural analysis problems. One of the most frequently applied computer programmes for linear analysis of structures under seismic input is the professional SAP2000 programme. The theory used as a basis for the elaboration of the programme shall be explained in details. This shall involve the mode of preparation of input data on the most diverse types of 2D and 3D models. Through interactive lectures, examples of structures shall be jointly solved for the effect of static and dynamic loads. Rationale shall also be given as to the preparation of input data for nonlinear analysis of structures by means of the COSMOS computer programme.
Management of Disaster Risks- Basic Disaster Management Aspects, Disaster Management Cycle, Main Activities, Disaster and National Development, Disaster Legislation, Counter-Disaster Resources, International Disaster Assistance, Leadership in Disaster, Organization, Plans, Utilization of Resources.

Long Term Measures, Prevention, Mitigation. Major Factors Prior to Disaster Impact, Preparedness; Response to Disaster Impacts, Response, Logistics; Major Post-Impact Factors, Recovery, Post-Disaster Review; Disaster Management Support Requirements, Training, Public Awareness, Research.

The UN International Decade for Natural Disaster Reduction (IDNDR), The Yokohama Strategy for a Safer World 1994-2005; The UN International Strategy for Disaster Reduction (ISDR), Hyogo Framework Document 2005-2015.

Planning for Seismic Risk Reduction -Fundamentals of seismic hazard analysis: seismic parameters for vulnerability and risk analysis. Earthquake damage and usability classification: inventory of elements at risk; damage and usability classification of buildings, transportation systems and lifelines, facilities with essential emergency functions, facilities with a potential for large loss. Development of vulnerability functions: empirical, experimental and analytical vulnerability functions for buildings and structures: damage potential and vulnerability of transportation

systems and lifelines. Vulnerability of non-aseismic and aseismic structures. Seismic risk analysis and loss prediction: presentation and density distribution of elements at risk, loss prediction potential, loss per element at risk, loss prediction potential, cumulative loss analysis and presentation; seismic risk analysis; optimization of seismic risk, acceptable level of seismic risk. Earthquake disaster management: strategies for earthquake disaster management, pre-disaster, planning for mitigation of seismic risk, post-disaster reduction of earthquake consequences.

Earthquake Codes -Introduction. Basic principles and parameters. Review of the earthquake codes in the world practice. Comparison of the seismic forces obtained by different codes. The strategy of developing the national earthquake codes. Code seismic design procedures - brief review of: the New Zealand approach to capacity design of RC structures, seismic design approach in the USA, the EC8 approach to capacity design of RC structures and capacity design method in Japan. Background of the Structural Eurocode programme. Eurocode progress-status, current stage of documents and NAD. Eurocode 2: Design of concrete structures-selected chapters. Eurocode 3: Design of steel structures-selected chapters. Eurocode 8: Design of structures for earthquake resistance-Part1.1 - Seismic actions and general requirements for structures; Part 1.2 - General rules for buildings and Part 1.3 - Specific rules for various materials and elements-(selected materials.)

Contemporary Natural and Man-Made Disasters- The Significance of Disaster, Traditional Disaster Threat, New Disaster Threat, Geography of Disaster, Modern Loss Factor, Major Aspects of Significance.

The Disaster Threat, General Effects of Disaster, Outlines of Individual Disasters, Process of Defining the Disaster Threat, Utilization of Disaster Threat Information; Fundamentals of Disasters, Causal Factors of Disasters, Poverty, Population Growth, Rapid Urbanization, Transitions in Cultural Practices, Environmental Degradation, Lack of Awareness and Information, War and Civil Strife.

Phases of Disaster, Rapid Onset Disasters, Slow, Onset Disasters, Characteristics of Particular Hazards and Disasters, Earthquakes, Tsunamis, Tropical Cyclones, Floods, Droughts, Environmental Pollution, Deforestation, Desertification, Epidemics, Chemical and Industrial Accidents.

Increasing Importance of Disasters, Disaster Survey and Assessment, Warning and Warning Systems, Counter-disaster Plans, Format of Plans, Planning Process, Critical Areas in Planning.

II. Specific subjects:

A. Building Structures:

Design and Construction of Earthquake Resistant Buildings - Learning from past earthquakes - damages of different building structures during recent earthquakes. Concepts of seismic design; seismic design and seismic performance. Seismic design limit states; structural systems for seismic resistance; influence of building configuration on seismic response. Definition of design quantities; earthquake seismic forces. Basic principles of earthquake resistant design of building structures and safety criteria. Methodology and approach for seismic design of structures. New trends for design of RC building structures; Philosophy of capacity design.

Reinforced-Concrete Structures - Strength and stress characteristics of concrete and reinforced steel for hysteretic behavior. Nonlinear behaviour of RC structural elements. Basic principles of nonlinear analysis of reinforced-concrete cross-section and members; the effect of bending, axial and shear forces; confining; ductility. Design of RC building structures; philosophy of design; design according different codes. Strength and ductility capacity of structural elements; nonlinear behaviour of RC beams and columns under monotonic and cyclic loading; methodology for determination of strength and displacement capacity for structural element and building structures. Inelastic response analysis of RC building structures under different earthquake effects; hysteretic behaviour of RC building structures. Methodology for earthquake resistant design of new RC structures and evaluation of seismic resistance of existing RC structures. Advanced seismic design methodologies-new trends. Computer programmes. Examples.

Prestressed and Prefabricated Structures. Basic characteristics of prestressed concrete and application of prestressed concrete in seismically resistant structures. Different types of prefabricated structures with basic characteristics and their application in seismically active regions.
Steel Structures - Learning from past earthquakes - damage of steel structures during recent earthquakes. Study of the nonlinear behavior of steel structural elements - beams, columns and joints under monotonic and cyclic loading. Plastic analysis of steel structural elements and joints. Secondary design problems-local buckling, lateral buckling and column stability. Structural steel systems. Evaluation of q-factor. Comprehensive methodology for ductility design - basis, required ductility and available ductility, influence of seismic actions, structural damage. EC3 and EC8-selected parts. Numerical examples-structural steel design and cheking of stress capacity ratio.
Masonry Structures -Behavior of masonry buildings during past earthquakes and characteristics of materials of masonry structures. Application on the basis of investigations according to modern approaches. Analysis of the bearing capacity and deformability. Design of earthquake resistance masonry structures.
Repair and Strengthening of Buildings -Methodology for repair and strengthening of earthquake damaged buildings. Technical aspects for different types of structural systems depending on the level of damage and expected earthquake acceleration. Examples and different experiences from different regions.

B. Engineering Structures

Aseismic Design of Industrial Buildings. Seismic performances and typical failure modes of industrial buildings in past earthquakes. General aseismic design concept, modelling and analysis approach to various industrial structures (industrial halls, integral systems, reservoirs, chimneys and other specific industrial facilities, base-isolated buildings). Application of code design and advanced, newly developed analysis procedures. Design of structural members and detailing. Application of modern analysis methods and advanced limited-state design concept. Recent achievements and their application in seismic isolation and vibration control systems.
Aseismic Design of Bridges -Seismic performance of highway bridges in past earthquakes. General concept for aseismic design of highway bridges. Code specification and advanced procedures. General requirements. Load combinations and design forces for structural members, foundation and connections. Design displacements. Foundations and abutments. Design of structural members and detailing. Application of modern analysis methods, and advanced capacity design concept for aseismic design of highway bridges. Recent achievements in aseismic isolation and vibration control systems for seismic resistance improvement of bridge structures. Long-span bridges (cable-stayed bridges) shall also be considered.
Aseismic Design of Dams -Introduction to earth fill, gravity and arch dams. Criteria ensuring static and seismic stability of dam structures under seismic effects. Seismic loads description. Mathematical models for analysis including three media defining hydrotechnical structures: water fluid dam body, rock massif. Dam body fluid integration. Application of finite elements method for discretization of dam body and rock massif. Application of contact elements for modeling of dam-rock contact zone. Dam body-rock interaction. Practical examples of estimation of static and seismic stability of dams.
Aseismic Design of Life-Line Structures -Life-line systems -definitions and classifications; behaviour and damage in past earthquakes; engineering practice and research; methodologies of life-line earthquake engineering; life-line vulnerability and seismic risk; fundamental concepts of aseismic codes; overview of existing design codes; post-earthquake serviceability and functional restoration; seismic damage rehabilitation, retrofitting and economic evaluation.
Repair and Strengthening of Structures -Introduction: typical failure modes of particular civil engineering structures, damage inspection, data collection and evaluation, emergency and post-earthquake reconstruction programmes. Repair and strengthening design procedure: Criteria for repair and/or strengthening of structures. Selection of repair and/or strengthening method. Repair and/or strengthening of

structural components and upgrading of integral structural systems of buildings, industrial halls, complex buildings, etc. Applicable analysis methods and structural methods for seismic safety evaluation of repaired structures, design improvement and detailing.

IV. Optional subjects

Introduction To Environmental Engineering- Environment, concept, ecological factors of environment, biotope, ecosystems. Pollution and protection of atmospheric air, main constituent elements of atmospheric air, sources of air pollution (natural) and sources of pollution of anthropogenic nature. Definition of major contaminants of atmospheric air and their effect upon living organisms, effects of atmospheric polluters upon material values, climatic changes resulting from pollution as well as preventive measures and methods for purification of polluted air. Pollution and protection of water, importance of water, quality of waters and quality indicators, biological evaluation of the extent of organic water pollution, measures and methods of protection of waters. Degradation and protection of soil, factors that adversely affect soil, measures and protection of soil. Solid waste, concept of solid waste and its classification, measures and methods of solving waste problems. Radioactive matter and environment, radioactive contamination of atmospheric air, radioactive contamination of organs and body tissues of animals, radioactive contamination of human organism, radioactive waste and possibilities for its elimination. Chemistry and environment, effect of chemical protective matters upon living organisms and environment. Noise and monitoring of environment.
Computer, Computer Practice and Numerical Analysis - Includes presentation of the state-of-the-art in computer practice as well as introduction to the basic concepts of numerical analysis and its application in common engineering and scientific problems. Use of personal computers. Training on computers. Since MATLAB (computer language/tools) is very frequently applied in engineering, it will be lectured at the Course.

In addition to the lectures and the practicals which are planned to be performed in the IZIIS premises, the programme also anticipates professional visit to accomplished engineering structures in R. Macedonia. Visits to structures under construction is also anticipated. These shall include presentations on the organization and mode of construction given by engineers.

The candidates will visit the bigger construction companies, too. During these visits, they will have the opportunity to talk with engineers who have designed important structures.

Final test and exams

Besides choosing one of the two specialized fields, Buildings or Engineering Structures, at the beginning of the Course, the participants are offered the possibility of choosing the most interesting subjects for them. The participants will concentrate on studies and practicals in relation to these subjects. There will be exams (optional) for these subjects.

At the end of the Course, a Final Test will be organized for all participants.

Upon completion of the Course, each participant will be awarded a Certificate for Attendance of the Course. Depending on the obtained marks, the participants will also be awarded certificates on completed Final Test or examinations in optional subjects.

Sports and social activities

In the spare time (afternoon hours), there will be sports and social activities. The candidates will have the IZIIS sports equipment available. Envisaged are also optional recreational sports activities in the covered pools of the city, the basketball and handball playgrounds.

Starting from the experience from the courses that have so far been held, attendance of cultural and entertainment events is also anticipated for the purpose of familiarization with the life style and the customs of the citizens of Republic of Macedonia.

For communication with the countries the candidates come from, IZIIS will provide Internet lines in the course of 24hours