

**CURRICULUM**  
**OF**  
**CIVIL ENGINEERING**  
**FOR**  
**MS**

(Revised 2017)



**HIGHER EDUCATION COMMISSION**  
**ISLAMABAD**

# **CURRICULUM DIVISION, HEC**

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**Composed by: Mr. Zulfiqar Ali, HEC, Islamabad**

# PREFACE

The curriculum, with varying definitions, is said to be a plan of the teaching-learning process that students of an academic programme are required to undergo to achieve some specific objectives. It includes scheme of studies, objectives & learning outcomes, course contents, teaching methodologies and assessment/ evaluation. Since knowledge in all disciplines and fields is expanding at a fast pace and new disciplines are also emerging; it is imperative that curricula be developed and revised accordingly.

University Grants Commission (UGC) was designated as the competent authority to develop, review and revise curricula beyond Class-XII vide Section 3, Sub-Section 2 (ii), Act of Parliament No. X of 1976 titled “Supervision of Curricula and Textbooks and Maintenance of Standard of Education”. With the repeal of UGC Act, the same function was assigned to the Higher Education Commission (HEC) under its Ordinance of 2002, Section 10, Sub-Section 1 (v).

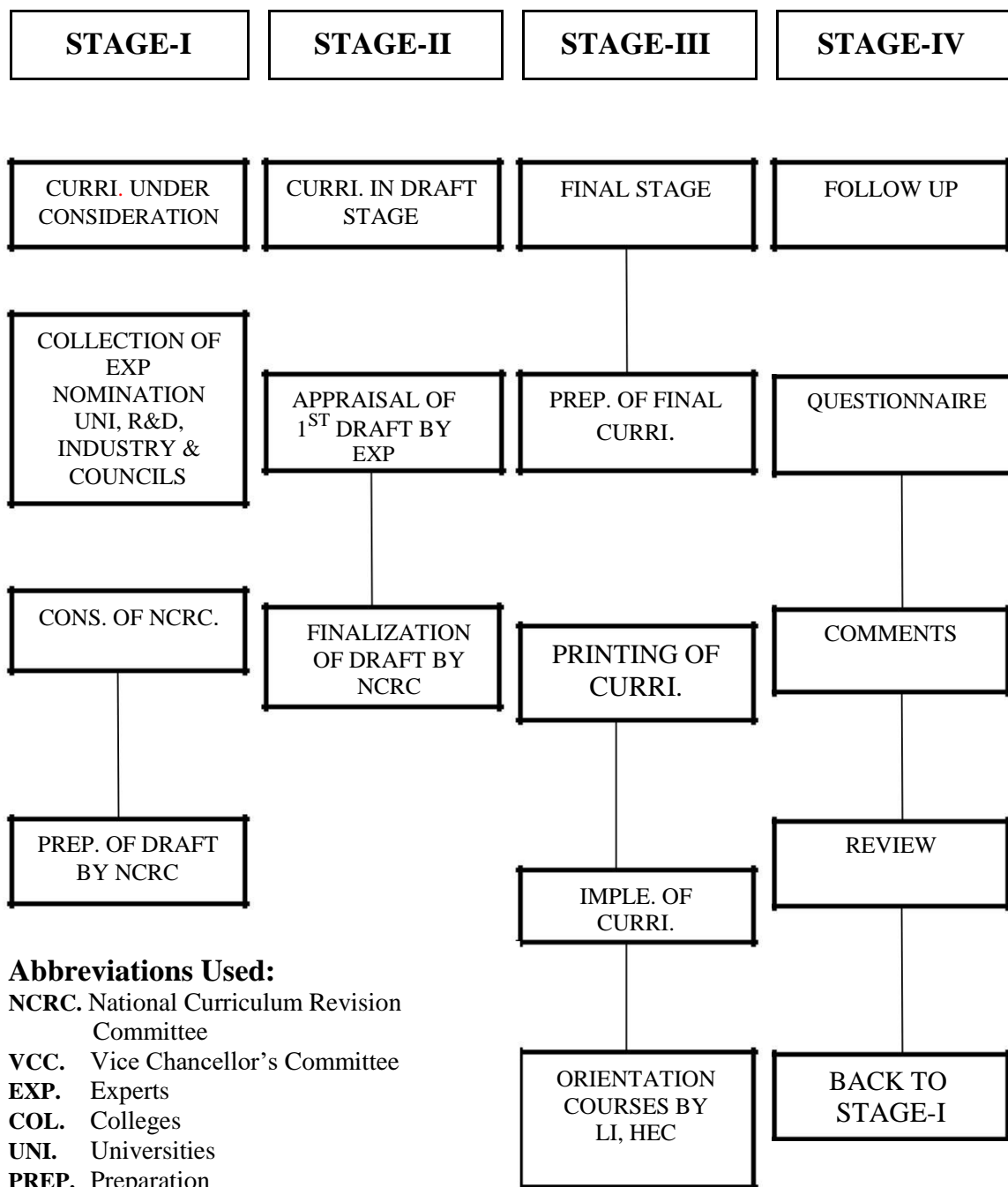
In compliance with the above provisions, the Curriculum Division of HEC undertakes the revision of curricula regularly through respective National Curriculum Revision Committees (NCRCs) which consist of eminent professors and researchers of relevant fields from public and private sector universities, R&D organizations, councils, industry and civil society by seeking nominations from their organizations.

In order to impart quality education which is at par with indigenous needs and international standards, HEC NCRCs have developed unified framework/ templates as guidelines for the development and revision of curricula in the disciplines of Basic Sciences, Applied Sciences, Social Sciences, Agriculture and Engineering.

It is hoped that this curriculum document, prepared by the respective NCRC’s, would serve the purpose of meeting our national, social and economic needs, and it would also provide the level of competency specified in Pakistan Qualification Framework to make it compatible with international educational standards. The curriculum is also placed on the website of HEC <http://hec.gov.pk/english/services/universities/RevisedCurricula/Pages/default.aspx>

**(Muhammad Raza Chohan)**  
**Director General (Academics)**

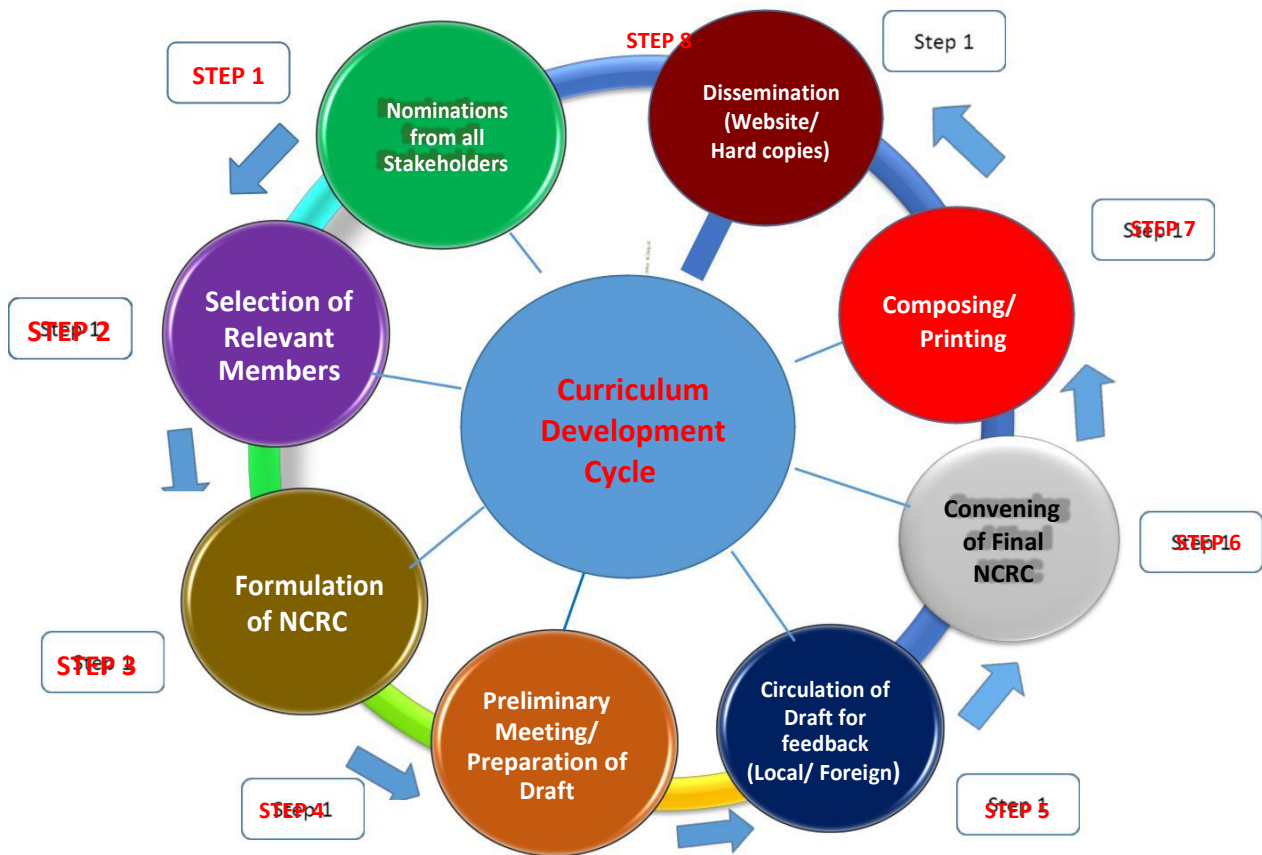
# CURRICULUM DEVELOPMENT



**Abbreviations Used:**

- NCRC.** National Curriculum Revision Committee
- VCC.** Vice Chancellor's Committee
- EXP.** Experts
- COL.** Colleges
- UNI.** Universities
- PREP.** Preparation
- REC.** Recommendations
- LI** Learning Innovation
- R&D** Research & Development Organization
- HEC** Higher Education Commission
- CONS:** Constitution

# CURRICULUM DEVELOPMENT CYCLE



## MINUTES OF FINAL MEETING:

The final meeting of National Curriculum Revision Committee (NCRC) in the discipline of Civil Engineering (BS & MS Programmes) was held from 08-10 May, 2017 (03 days) at Higher Education Commission (HEC), Regional Centre, Lahore. Experts from academia and industry as well as entrepreneurs participated in the meeting. Dr. Muhammad Idrees (Director, Academics Division, HEC, Pakistan) coordinated the meeting. The list of the participants of final meeting is as below:

S. N	Name & Institution	Position
1	Prof. Engr.Dr. Hamza Farooq Gabriel ( <b>Convener</b> ) Professor / HoD, NUST Institute of Civil Engineering, National University of Sciences & Technology, H-12, Kashmir Highway, Islamabad.	Convener
2	Prof. Engr.Dr. Habib-ur-Rehman Mughal ( <b>Secretary</b> ) Professor, Department of Civil Engineering, University of Engineering & Technology, Lahore.	Secretary
3	Prof. Engr. Dr. Qaiser uz Zaman Khan Professor, Faculty of Civil & Environmental Engineering, Department of Civil Engineering, University of Engineering & Technology, Taxila.	Member
4	Prof. Engr. Dr. Abdul Jabbar Sangi, Professor, Department of Civil Engineering, NED University of Engineering & Technology, University Road, Karachi.	Member
5	Prof. Engr. Dr. M.A.Q Jahangir Durrani Dean, Iqra National University, Phase-II, Hayatabad, Peshawar	Member
6	Engr. Dr. Majid Ali, Associate Professor, Department of Civil Engineering, Capital University of Science & Technology, Kahuta Road, Zone-V, Islamabad.	Member
7	Engr. Dr. Shaukat Ali Khan Associate Professor, HoD, Department of Civil Engineering Abasyn University, Peshawar	Member
8	Engr. Dr. Rao Arsalan Khushnood, Assistant Professor, NUST Institute of Civil Engineering, National University of Science & Technology, H-12, Kashmir Highway, Islamabad.	Member
9	Engr. Dr. Farrukh Arif, Assistant Professor, Department of Civil Engineering, NED University of Engineering & Technology, University Road, Karachi.	Member

10	Engr. Dr. Muhammad Irfan ul Hassan Assistant Professor, Department of Civil Engineering, University of Engineering & Technology, Lahore.	Member
11	Engr. Abdul Qadeer General Manager NESPAK, Islamabad.	Member
12	Dr. Muhammad Idrees ( <b>Coordinator</b> ) Director Academic, Higher Education Commission, Islamabad	Coordinator

List of members who attended preliminary meeting held from November 30 to December 2 2016 (03 days) at HEC Regional Center, Peshawar but could not attend final meeting due to their personal engagements during these dates is as below:-

1	Engr. Dr. Mohammad Ashraf. Associate Professor, Department of Civil Engineering, University of Engineering & Technology, Peshawar.	Member
2	Engr. Dr. Qaiser Iqbal, Assistant Professor, Department of Civil Engineering, Sarhad University of Science & Information Technology, Peshawar.	Member
3	Engr. Zulfiqar Ali, Assistant Professor, Department of Civil Engineering, Balochistan University of Engineering & Technology, Khuzdar.	Member

List of members who had not attended the preliminary meeting but attended final meeting is as below:-

1	Prof. Engr. Dr. Abdul Sattar Shakir, Dean, Faculty of Civil Engineering, University of Engineering & Technology, Lahore.	Member
2	Prof. Engr. Dr. Khalid Farooq Director, Geotechnical Engineering Laboratory Department of Civil Engineering, University of Engineering & Technology, Lahore.	Member
3	Prof. Engr. Dr. Ammad Hassan Khan Chairman, Department of Transportation Engineering and Management, University of Engineering & Technology, Lahore.	Member

## NCRC Agenda

The agenda of NCRC for Civil Engineering was as follows:

1. To revise/finalize the Civil Engineering curriculum (2012) for Bachelor's and Master's Programmes according to indigenous needs and to bring it at par with international standards.



2. To revise/finalize preface, mission, vision, preamble, and rationale of the subject.
3. To revise/finalize objectives/learning outcomes, list of contents and assessment criteria (formative & summative) and align these with undergraduate programmes (vertical approach) and other Master's programmes (horizontal approach).
4. To incorporate/finalize latest reading materials/references (local & international) for every course.
5. To revise/finalize course contents keeping in view the uniformity across other disciplines and avoiding overlapping.
6. To make recommendations for promotion/development of the discipline, keeping in view the futuristic needs of the society and international trends.

The meeting started with recitation from the Holy Quran. Dr. Muhammad Idrees, Director, Academics Division, HEC, Islamabad welcomed the participants. All the participants introduced themselves highlighting their qualification, experience and area of expertise within the discipline of Civil Engineering. Keeping with the tradition, Dr. Muhammad Idrees, Director Academics Division, HEC, Islamabad suggested the house to opt the Convener and Secretary of the preliminary NCRC for smooth functioning which was unanimously agreed.

Dr. Muhammad Idrees presented the agenda and objectives of the NCRC. He highlighted the importance of this meeting and emphasized for adaptation of general rules of curriculum development and revision like scope of the subject/programme, horizontal & vertical alignment, rule of flexibility and adaptability keeping in view the futuristic approach, market value/job market and societal needs. He also shared a template for revising/updating the curricula. The template was unanimously accepted to be followed.

In next session the house openly discussed the nomenclature of the discipline, preface, vision, mission, programme educational objectives (PEOs), programme learning outcomes (PLOs), course learning outcomes (CLOs), methods of instruction and learning environment, assessment and operational framework. After long deliberation, the committee finalized the above said segments of the curriculum. Similarly, framework/scheme of studies of undergraduate 4-years programme for Civil Engineering was discussed and finalized keeping in view the duration of the programme, number of semesters, number of weeks per semester, total number of credit hours, number of credit hours per semester, weightage of engineering and non- engineering courses and weightage of theory and practical. Furthermore, list of courses (core & elective) and semester wise breakup of courses were also discussed thoroughly and the same was unanimously finalized.

In the afternoon session, admission criteria/intake criteria was discussed and finalized. After that the list of courses was distributed among the committee members keeping in view the experience and expertise in the field for reviewing/finalizing course objectives, adding learning outcomes, updating list

of contents, adding teaching-learning methods and assessment, and updating bibliography/ references/ suggested books.

On second day, task assigned to the groups was displayed and discussed the addition/deletion and revising the courses. After through deliberation, draft curriculum of the Undergraduate/Bachelor's (BE/BSc./BS) (4-year) for Civil Engineering was finalized.

On third day, the courses of Postgraduate (ME/MSc/MS/MEM) programme of Civil Engineering was reviewed and after through discussion list of courses were finalized.

In the end, Dr. Idrees thanked the Convener, Secretary and all members of the Committee for sparing their time and for their contribution to prepare the final draft of the curriculum. The Convener of the NCRC also thanked the Secretary and members for their inputs in revising/updating the curriculum to make it more practical, competitive, efficient and realistic. The committee highly appreciated the efforts made by the officials of HEC Regional Centre, Lahore for making arrangements to facilitate the committee and their accommodation. The meeting ended with the vote of thanks to Dr. Muhammad Idrees and his team from HEC for providing this academic and professional opportunity for national cause.

## **RECOMMENDATIONS BY NCRC**

### **Recommendations for Undergraduate Programme**

1. To make better understanding of the students towards reinforced concrete, presently available 02 courses may be enhanced to 03 courses. One additional course of 'Concrete Technology' may be added. The other two subjects should be 'Reinforced Concrete Design-I' and 'Reinforced Concrete Design-II'. Currently, the course was not added due to limitation of total credit hours.
2. Course of 'Design of Structures' may be considered to be accommodated in the syllabus of civil engineering in forthcoming NCRC meeting.
3. For having expert opinion on courses of 'Islamic Studies' and 'Pakistan Studies', relevant experts may be invited in the next NCRC meeting.
4. More elective courses in core civil engineering streams may be incorporated.
5. Considering the global warming issue, topic of 'Climate Change' may be included in the existing 'Environmental Engineering-II' course.

# RECOMMENDATIONS FOR POSTGRADUATE PROGRAMME

1. NCRC should also develop and update the curriculums (course outlines) for the postgraduate programmes, for which separate field of specialization based committees should be constituted.
2. Faculty involved in teaching the post graduate evening programmes should be furnished with separate reasonable financial incentives.
3. To promote research culture in the country, research based masters programs should also be encouraged.
4. Laboratory / Design work should be ensured in subjects where required.

## General Recommendations for Civil Engineering Discipline

1. Bachelor programs which are off shoots of Civil Engineering should be included for Curriculum revision through NCRC meeting of Civil Engineering Program.
2. HEC may facilitate Continuous Professional Development (CPD) program in collaboration with institutions like; Pakistan Engineering Council (PEC), Institute of Engineers Pakistan (IEP), and Pakistan Engineering Congress (PEC).
3. The NCRC recommends that all new programmes may be regularized following the accrediting authority's requirements.
4. Every academic institution should have an Academic Calendar to be strictly followed throughout the academic year.
5. Use of available software(s) for engineering applications should be encouraged.
6. Internship / training of 4-6 weeks should be considered necessary.
7. HEC should facilitate for publication of textbooks for each course designed by National Curriculum Review Committee.
8. There should be Directorate of Industrial Liaison/Placement Bureau in every engineering institution/university working in coordination with HEC to promote, facilitate training/career opportunities for its students.
9. Renowned specialists from the academia/industries may be invited as guest speakers for extension lectures covering latest developments in the field.
10. Field visits to significant installations and infrastructure facilities should be arranged for students on regular basis.

Prof. Dr. Hamza Farooq Gabriel (**CONVENER**)-----

Prof. Dr. Habib-ur-Rehman Mughal (**SECRETARY**)-----

Dr. Muhammad Idrees (**COORDINATOR**)-----

**VISION:**

To strengthen teaching, research and innovation in Civil Engineering by producing human capital that delivers professional services and leadership contributing for sustainable development.

**MISSION:**

To impart high quality Civil Engineering education through modern teaching and tools for socioeconomic development so as to produce graduates who are prepared to lead and excel as professionals.

**PREAMBLE:**

The Civil Engineering programme provides the necessary technical skills in engineering design/analysis as well as mathematics and basic sciences consistent with Higher Education Commission (HEC) and Pakistan Engineering Council (PEC) accreditation standards and national development needs. A Civil Engineering graduate would be able to undertake planning, design, construction, operations and maintenance of urban and rural infrastructure by applying his/her knowledge in all stages of Civil Engineering and inter-disciplinary projects.

The curriculum design is a critical component and backbone of the educational structure in any nation. Curriculum is one of the key representative yardstick through which the stage and pace of socio-economic development of a nation can be assessed. The advent of new technology has turned the world into a global village. In view of tremendous research taking place world over new ideas and information is being added at a rapid pace making it imperative to update the curricula at regular intervals, for introducing latest development and innovation in the relevant field of knowledge.

**RATIONALE**

Considering the recent advancements in the science and technology and their impacts in the field of Civil Engineering, coupled with contemporary requirements of Outcome Based Education (OBE), there is a dire need to update the curriculum of BE/BSc/BS and ME/MSc/MS/MEM Civil Engineering programs.

**SCOPE**

The scope of the document is to provide minimum standards and guidelines for the development, delivery and assessment of the curriculum of Civil Engineering programs. The guideline areas include; Program Educational Objectives (PEOs), Program Learning Outcomes (PLOs), Course Objectives, Course Learning Outcomes (CLOs) of core courses, scheme of studies, course outlines, credit hours distribution, suggested assessment methods, and recommendations.

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

Following are the sample program educational objectives that are expected to be exhibited by the civil engineers after 3-5 years of their graduation. Civil engineering professionals will:

1. Demonstrate sound knowledge and skills.
2. Work, manage and illustrate effective teamwork, interpersonal skills and professional growth.
3. Undertake professional practice considering ethical, societal and environmental implications.

**Note:** *Institutions are expected to customize their own PEOs for their respective program requirements.*

## **PROGRAM LEARNING OUTCOMES (PLOs)**

Program outcomes are the narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills and attitude that the students acquire while progressing through the program. The program must demonstrate that by the time of graduation the students have attained a certain set of knowledge, skills and behavioral traits, at least to some acceptable minimum level.

The sample Program Learning Outcomes (PLOs) of Civil Engineering are based on graduate attributes of PEC Accreditation Manual 2014 and are given below:

**PLO-01: Engineering Knowledge:** Ability to apply knowledge of mathematics, science and engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

**PLO-02: Problem Analysis:** Ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

**PLO-03: Design/Development of Solutions:** Ability to design solutions for complex engineering problems and design systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

**PLO-04: Investigation:** Ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

**PLO-05: Modern Tool Usage:** Ability to 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.

**PLO-06: The Engineer and Society:** Ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.

**PLO-07: Environment and Sustainability:** Ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

**PLO-08: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

**PLO-09: Individual and Team Work:** Ability to work effectively, as an individual or in a team, on multifaceted and/or multidisciplinary settings.

**PLO-10: Communication:** Ability to communicate effectively, orally as well as in writing 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 documentations, make effective presentations, and give and receive clear instructions.

**PLO-11: Project Management:** Ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team to manage projects in a multidisciplinary environment.

**PLO-12: Lifelong Learning:** Ability to recognize importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

## **COURSE LEARNING OUTCOMES (CLOs)**

The course learning outcomes (CLOs) are linked to the PLOs and communicated by the given course content. CLOs are directly assessed from:

- ✓ One Hour Tests (OHTs) / Midterm Tests
- ✓ End Semester Exam (ESE)
- ✓ Lab Reports
- ✓ Complex Engineering Problems

Guidelines for CLOs' domain and levels are given in **Appendix-1**. For further details, please refer to PEC Accreditation Manual 2014.

## **METHODS OF INSTRUCTIONS AND LEARNING**

**ENVIRONMENT** This shall comprise the following:-

Classroom lectures, duly supported by audio-visual aids, demonstrations and relevant handouts

Assignments and tutorials requiring use of reference materials and internet facility

Homework load for the students should be rationalized considering the credit hours and nature of the course

Semester projects and class presentations

Laboratory experiments and design exercises

Complex Engineering Problems as assignments

(CEPs) Final year projects (FYPs)

Field works such as survey camp, community services and internship

Instructional visits to appropriate establishments, installations, construction sites, field stations, industries etc.

Extension lectures and class room discussions by renowned professionals

Enhanced use of modern computing facilities in the institutions

The notebooks/field books/graphs and drawing sheets pertaining to the field work and practical should be completed within the allocated time and submitted to the teacher. In case of field visit, the students shall be required to write a visit report

## **ASSESSMENT**

1. Classroom attendance, class assignments, class tests, homework assignments, quizzes, viva voce, presentations etc., should be considered for the award of sessional marks.
2. Structured rubrics are encouraged to be used for the assessment of Laboratory work, class performance, Complex Engineering Problems (CEPs), field survey, semester projects and Final Year Project (FYP).
3. The academic pursuit and achievements of a student in a semester/academic year are to be evaluated by holding semester examinations.
4. Final year courses may be evaluated by external/neutral examiners, in addition to internal examiner.
5. Final year projects shall preferably be evaluated by both external and internal examiners.

## **OPERATIONAL FRAMEWORK**

1. Following the HEC guidelines, an operational framework is developed which includes both engineering and non-engineering courses as detailed in summary table titled "**BSc/BE/BS CIVIL ENGINEERING PROGRAMME**".
2. Every Engineering University in Pakistan covers different areas in respect of professional civil engineering applications. However, objectives of Bachelor of Civil Engineering Courses are same. Considering this aspect, the courses

suggested are such that the civil engineering graduates from all universities are at par and at the same time be prepared to meet the national and international requirements. The curriculum designed has the room for individual universities to adjust courses as per their local requirements.

3. **Number of contact hours:** The contact hours for study of courses are kept for university to university, considering the variation in local requirements. The following scheme is recommended:
  - a. 1 credit hour of theory class = 1 contact hour
  - b. 1 credit hour of lab / design class / practical = 3 contact hours
4. The evaluation of the students will be made on the basis of grading system in-line with the guidelines of the HEC.
5. **Course Contents:** Course contents of each course are being provided as guidelines to meet the requirement of uniformity. However, the universities are at liberty to formulate their respective course plans.
6. **Practical/Design Classes/Field Work:** The Laboratory Experiments/ Practical/Design Classes/Field Works shall be in conformance with the contents of the respective course.



# **List of Courses for MSc/MS/ME/MEM in Civil Engineering**

## **MS Induction criteria**

Admission criteria to MS/MSc/ME/MEM programs shall be as per HEC guidelines.

The courses given in the following sections are provided for different fields of specializations. The programs may include customized courses based on the specific requirements.

## **MSc/MS/ME in Structural Engineering**

1.	Advanced Structural Analysis
2.	Advanced Reinforced Concrete
3.	Properties of Structural Materials
4.	Prestressed Concrete
5.	Advanced Steel Structures
6.	Non Linear Structural Analysis
7.	Finite Element Method
8.	Reliability Based Structural Design
9.	Advanced Mechanics of Solids
10.	Fiber Reinforced Polymers
11.	Structural Fire Engineering
12.	Design of Masonry Structures
13.	Seismic Analysis and Design
14.	Bridge Engineering
15.	Design of Special Structures
16.	Theory of Plates and Shells
17.	Stability of Structures
18.	Structural Dynamics
19.	Repair, Maintenance and strengthening of Structures
20.	Structural Optimization
21.	Durability of Concrete Structures
22.	Design of Tall Structures
23.	Serviceability of Concrete Structures
24.	Seismology and Earthquake Engineering
25.	Structural Assessment and Rehabilitation
26.	Computational Modeling of Materials and Structures
27.	Advanced Concrete Technology
28.	Fracture Mechanics
29.	Fiber Reinforced Composites

30.	Performance Based Seismic Design
31.	Computer Methods in Structural Analysis
32.	Nanotechnology in Concrete
33.	Wind Engineering in Structures
34.	Research Methods in Engineering
35.	Probability and Statistics

**MS/ME in Hydraulics & Irrigation Engineering, Water Resources Engineering and Management, Water Resources Engineering, Water Resources and Irrigation Engineering or any other relevant specialization in water resource engineering**

1.	Hydraulic Structures
2.	Advanced Fluvial Hydraulics
3.	Hydropower Engineering
4.	Irrigation Engineering & Practices
5.	Applied Hydrology
6.	Sediment Transport
7.	Advanced Fluid Mechanics
8.	Drainage Engineering
9.	Computer Aided Design of Hydraulic Structures
10.	River Engineering and Flood Management
11.	Application of RS & GIS
12.	Soil Erosion & watershed Management
13.	Hydrological Systems Modeling
14.	Water Resources Economics, Planning & Management
15.	Ground Water Engineering
16.	Advanced Open Channel Hydraulics
17.	Computational Hydraulics
18.	Hydrodynamics
19.	River Flood Modelling
20.	Urban Flood Management
21.	Dam Engineering
22.	Water Supply and Sewer System Design
23.	Irrigation System Design and Management
24.	Data Driven Modelling and Real Time Control of Water Systems
25.	Modelling Theory and Information Management
26.	Design and Construction of Earthen Dam
27.	Coastal Engineering
28.	River Basin Modelling
29.	Climate Change and Hydrological Cycle
30.	Water Law and Policy
31.	Planning, Development, and Management of Hydropower Systems

32.	Design of Hydropower Plants
33.	Hydrometeorology
34.	Water management Computations
35.	Watershed Management
36.	Legal and Financial Aspects of Water Resources
37.	Sustainable Water Resource Management
38.	Reservoir Operation
39.	Groundwater Resource Management
40.	Water Quality Management
41.	Research Methods in Engineering
42.	Probability and Statistics

### **MSc/MS/ME in Geo-Technical Engineering**

1.	Advanced Soil Mechanics
2.	Foundation Engineering
3.	Deep Foundations
4.	Dam Engineering
5.	Geotechnical Investigation
6.	Soil Improvement Techniques
7.	Rock Engineering
8.	Environmental Geo-techniques
9.	Soil Dynamics
10.	Bridge and Tunnel Engineering
11.	Soil Erosion & Watershed Management
12.	Ground Water Engineering
13.	Engineering Properties of Soil
14.	Earth Reinforcement
15.	Earth Retaining Structures
16.	Pavement Analysis and Design
17.	Soil Structure Interaction
18.	Slope Stability
19.	Advanced Geotechnical Design
20.	Design and Construction of Earthen Dam
21.	Rock Mechanics
22.	Geo Environmental Engineering
23.	Numerical Methods in Geotechnical Engineering
24.	Research Methods in Engineering
25.	Probability and Statistics

## MSc/MS/ME in Transportation Engineering

1.	Transportation Planning and Engineering
2.	Geometric Design and Highway Safety
3.	Pavement Analysis and Design
4.	Traffic Engineering and Management
5.	Airport Planning and Design
6.	Railway Engineering
7.	Pavement Evaluation and Rehabilitation
8.	Planning for Traffic Safety and Injury Prevention
9.	Pavement Management Systems
10.	Highway construction Materials & Equipment
11.	Harbor and Dock Engineering
12.	Bridge and Tunnel Engineering
13.	Asphalt Mix Design and Construction
14.	Pavement Distress identification and Preservation
15.	Advanced Probability and Statistics for Transportation Engineering
16.	Application of RS & GIS
17.	Transportation Infrastructure Asset Management
18.	Urban Transport System Evaluation
19.	Public Transportation system
20.	Traffic Management Analysis
21.	Traffic Impact and Safety Studies
22.	Geotechnical Aspects of Highways
23.	Traffic Flow Theory
24.	Intelligent Transportation System (ITS)
25.	Transportation Economics
26.	Waterways Transportation
27.	Travel Demand Forecasting
28.	Research Methods in Engineering
29.	Probability and Statistics

## MSc/MS/MEM in Construction Engineering and Management

1.	Construction Project Administration
2.	Construction Planning, Scheduling and Control
3.	Safety Management in Construction
4.	Contract Management
5.	Cost Engineering and Control
6.	Economic Decision Analysis in Construction
7.	Leadership in Construction Management
8.	Construction Equipment Management
9.	Value Engineering in Construction
10.	Human Resource Management in Construction Industry
11.	Supply Chain Management in Construction Industry
12.	Decision Making and Risk Management in Construction
13.	Construction Operations and Development of Technologies
14.	Entrepreneurship in Construction Industry
15.	Construction Claim Management
16.	Regional Development Planning
17.	Social Engineering for Sustainable Development
18.	Public Infrastructure Management
19.	Planning and Management of Housing
20.	Energy Management in Buildings
21.	Sustainable Development and Construction
22.	Environmental Impact Assessment
23.	Fundamentals of Disaster Management
24.	Policies, Planning and Strategies for Disaster Management
25.	Community Based Disaster Risk Management
26.	Vulnerability Analysis and Hazard Mitigation
27.	Real Estate Management
28.	Occupational Health and Safety in Construction
29.	Total Quality Management (TQM)
30.	Project Evaluation and Feasibility Analysis
31.	Project Management Framework and Tools
32.	Advanced Bidding and Estimating
33.	Constructional Failure Analysis
34.	Research Methods in Engineering
35.	Probability and Statistics

## **MSc/MS/ME in Coastal Engineering**

1.	Introduction to Ocean and Coastal Engineering
2.	Applied Hydrology
3.	Marine Pollution and Control
4.	Coastal Processes
5.	Coastal Management
6.	Port Planning and Design
7.	Soil Mechanics in Coastal Engineering
8.	Marine Geology
9.	Marine Dredging
10.	Off-shore Engineering Analysis
11.	Computational Hydraulics
12.	Design of Marine Structures
13.	Tsunami Inundation Modelling
14.	Sea Water Intrusion
15.	RS and GIS Applications
16.	Mathematical Methods for Engineers
17.	Research Methods in Engineering
18.	Probability and Statistics

## **MSc/MS/ME in Earthquake Engineering**

1.	Structural Dynamics
2.	Fundamental of Earthquake Engineering
3.	Seismic Design of Structures
4.	Advanced Structural Analysis
5.	Fundamentals of Earthquake Engineering
6.	Displacement Based Seismic Design
7.	Performance Based Seismic Design
8.	Seismic Design of Steel and Composite Structures
9.	Seismic Design of Masonry Structures
10.	Loss Estimation and Hazard Mitigation
11.	Engineering Seismology
12.	Dynamic Soil Structure Interaction
13.	Seismic Risk Reduction
14.	Policies, Planning and Strategies for Disaster Management
15.	Seismic Design of Life-Line Structures
16.	Seismic Assessment and Rehabilitation of Structures
17.	Structural Reliability Analysis
18.	Vibration Control and Dissipation Mechanisms
19.	Seismic Design of Shell Structures
20.	Research Methods in Engineering
21.	Probability and Statistics
22.	<u>Structural Dynamics</u>
23.	Fundamental of Earthquake Engineering
24.	Seismic Design of Structures
25.	Advanced Structural Analysis

26.	Fundamentals of Earthquake Engineering
27.	Displacement Based Seismic Design
28.	Performance Based Seismic Design
29.	Seismic Design of Steel and Composite Structures
30.	Seismic Design of Masonry Structures
31.	Loss Estimation and Hazard Mitigation
32.	Engineering Seismology
33.	Dynamic Soil Structure Interaction
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35.	Policies, Planning and Strategies for Disaster Management
36.	Seismic Design of Life-Line Structures
37.	Seismic Assessment and Rehabilitation of Structures
38.	Structural Reliability Analysis
39.	Seismic Design of Shell Structures

