

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

**COURSE TITLE: CONSTRUCTION QUALITY CONTROL & MONITORING
(COURSE CODE: 3360602)**

Diploma Programme in which this course is offered	Semester in which offered
Civil Engineering/Transportation Engineering	Sixth

1. RATIONALE

Developing countries like India where lots of infrastructure development is undergoing, knowledge and understanding of quality control & monitoring in construction work is very important in order to achieve good quality product within the stipulated time period. For any civil construction work, day to day monitoring and inspection plays a very important role for durable and sustainable structure. Good quality control and monitoring may increase lives of civil structures by 40 to 50 years without much increase in cost of construction. Lots of infrastructure development works are underway and construction resource materials are depleting, under this circumstances, proper use of natural resources are very essential and necessary. Therefore the study of green building concepts and quality control aspects are essential for diploma students to perform their job, duties in the field efficiently and effectively. This course is more important for diploma engineers since they work in the supervisory capacity and in this capacity it is their main responsibility to ensure quality of construction.

2. COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency:

- **Control and monitor quality in civil construction works effectively and efficiently.**

3. COURSE OUTCOMES (COs)

The theory should be taught and exercises should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Apply total quality management in civil construction.
- Check the quality in civil construction works.
- Identify the variations in quality of civil works.
- Use various standard codes in civil construction works.
- Design energy efficient buildings.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (InHours)			TotalCredits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		PracticalMarks		
L	T	P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	150

Legends: L- Lecture- Tutorial/Teacher Guided Student Activity; P - Practical; C Credit; ESE-End Semester Examination; PA-Progressive Assessment.

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in Cognitive Domain)	Topics and Sub-topics
Unit-I Total Quality Management (TQM) in Construction	1a. Explain features of TQM 1b. Apply various quality checks. 1c. Distinguish between quality control and quality assurance. 1d. List precautions to be taken for accurate measurement	1.1 Concept of quality control, Quality assurance, Quality management. 1.2 Aims of TQM 1.3 Development and design Concept of TQM 1.4 Accuracy and precision in observation, reading, calibration, testing, measurements, recording of data and information etc. 1.5 Accuracy in calculation, finding area, volume, etc.
Unit-II Construction Quality Control Inspection Program	2a. Describe various aspects of QCIP. 2b. Explain QC aspects of various construction activities. 2c. List tests for ensuring quality of cement and bricks. 2d. List tests to ensure the quality of concrete. 2e. List precautions to be taken for ensuring better quality of RCC. 2e. List dos and don'ts for ensuring quality in plumbing and drainage work.	2.1 Duties, responsibilities, qualification of staff in organization. 2.2 Checklists for <ul style="list-style-type: none"> - Quality of Materials - Masonry - Plastering, - Concrete construction- Batching, Mixing, Transporting, Placing, Compaction, Finishing, Curing - Reinforcement Work - Formwork - Timber & steel construction, - Doors & windows, - Plumbing & drainage.

<p>Unit-III</p> <p>Statistical Quality Control & Monitoring</p>	<p>3a. Describe statistical quality control methods.</p> <p>3b. Explain variables and attributes related to control charts.</p> <p>3c. Explain SPC and its importance</p> <p>3d. Describe different types of Attribute-sampling plans.</p> <p>3e. Explain acceptance sampling.</p> <p>3f. Interpret different type of charts.</p>	<p>3.1 Statistical Quality Control</p> <p>3.2 Quality Measurement: Attributes and Variables</p> <p>3.3 Statistical Process Control (SPC) Methods</p> <p>3.4 Control Charts for Attributes: p-Charts - Proportion Defective c-Charts - Number of Defects Per Unit</p> <p>3.5 Control Charts for Variables</p> <p>3.6 Other Types of Attribute-Sampling Plans</p> <p>3.7 Acceptance Sampling</p>
<p>Unit-IV</p> <p>Quality Standards</p>	<p>4a. Use various quality standard codes from its application point of views.</p> <p>4b. List important clauses with range of acceptable parameters related to quality of cement, bricks, steel and concrete as given in quality standards.</p> <p>4c. List important provisions of Indian standards about different construction activities.</p> <p>4d. Explain the main features of ISO9000 and ISO14000 standards.</p>	<p>4.1 Quality standards in construction related to Building materials and other inputs for construction processes.</p> <p>4.2 Quality standards for Construction outputs, products and services.</p> <p>4.3 Indian Standard Code (a) Methods of referring it (b) Use of IS for quality references</p> <p>4.4 National Building code (NBC 2005) (a) Why to refer & How to refer (b) Methods of referring it & application.</p> <p>4.5 Study of International Organization for Standardization (ISO) (a) ISO-9000, ISO14000 & certification procedures.</p>

Unit-V Sustainable Built Environment- Green Building	5a. Explain concepts and goals of green building. 5b. Describe provisions to be made for green building. 5c. Describe provisions to be made for energy efficiency, material efficiency, water efficiency etc. 5d. Explain the concept of siting and structure design efficiency. 5d. Explain techniques for waste reduction. 5e. Suggest methods for enhancing indoor environmental quality.	5.1 Green building – 5.2 Definition – Green Building, Green Construction, Sustainable building 5.3 Goals of Green building 5.4 Advantages and disadvantages 5.5 Strategies 5.6 Certification Agencies – GRIHA, LEED (Highlights & Criteria) 5.7 Life cycle assessment (LCA) 5.8 Siting and structure design efficiency 5.9 Energy efficiency 5.10 Water efficiency 5.11 Materials efficiency 5.12 Indoor environmental quality enhancement 5.13 Operations and maintenance optimization 5.14 Waste reduction
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6. SUGGESTED SPECIFICATION TABLE WITH HOURS&MARKS (Theory)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Total Quality Management (TQM) in Construction	7	4	3	4	11
II	Construction Quality Control Inspection Program	10	6	6	5	17
III	Statistical Quality Control & Monitoring	10	6	6	5	17
IV	Quality Standards	8	6	4	4	14
V	Sustainable Built Environment- Green Building	7	4	3	4	11
Total		42	26	22	22	70

Legends: R = Remember, U = Understand, A= Apply and above Level (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

7. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes mainly in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

Sr. No.	Unit No.	Practical/Exercises (outcomes in psychomotor domain)	Approx. Hours Required
1	I	Prepare Charts highlighting important features of TQM as applicable to construction.	6
2	II	Prepare various construction check lists for processes as well as for material quality	8
3	III	Solve 8 examples related to statistical quality control and statistical process control	6
4	IV	Prepare charts of important clauses of of NBC & ISO	4
5	V	Visit nearby Green Building & make a visit report comparing it with non-green building	4

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Visit the Civil Material Testing lab & prepare a report on material testing.
- ii. Visit ongoing construction site & prepare a report on quality checks.
- iii. Prepare a list showing various codes used in civil construction activity.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- i. Arrange site visit to a large construction project and discuss different quality control and monitoring measures being employed.
- ii. Show video films on testing of different materials
- iii. Arrange expert lectures of reputed contractors/builders/Engineers of Civil departments on quality control issues.
- iv. Present case studies of failures in construction projects due to quality problems.

10. SUGGESTED LEARNING RESOURCES

A. BOOKS:

No.	TITLE	AUTHOR	PUBLISHER
1	Total Quality Management	G.Kanji	Springer Science & Business Media
2	Fundamentals of Quality Control and Improvement	Amitva Mitra	Wiley India Private Limited
3	Manual on Quality Control	--	Gujarat Engineering Research Institute
4	Ambuja Technical Literature Series	--	Ambuja Cements
5	National Building Code, ISO 9000/14000 and other standards		

B. Learning Website:

- i. www.nptel.ac.in
- ii. <http://ndrfandcd.gov.in/Cms/NATIONALBUILDINGCODE.aspx>
- iii. http://en.wikipedia.org/wiki/Green_building_in_India

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculties from Polytechnics, Gujarat

- **Prof. V. K. Shah**, H.O.D., Civil Engg. Deptt., Dr. S. & S.S. Gandhi Engg. College, Surat.
- **Prof. Krishnaraj A. Khatri**, Lecturer in Civil Engg. Deptt. B.V.P.I.T. (D.S.), Umrah, Bardoli.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. M. C. Paliwal**, Associate Professor, Department of Civil and Environmental Engineering.
- **Prof. K. K. Pathak**, Professor, Department of Civil and Environmental Engineering.