GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: All branches
Subject Code: BE02R00071
Subject Name: Standardization and Quality Ecosystem

w. e. f. Academic Year:	2025-26
Semester:	2
Category of the Course:	Multidisciplinary Open Professional Electives Courses

Prerequisite:	NA
Rationale:	The Standardization and Quality Ecosystem course introduces students to the principles, processes, and institutions that define quality infrastructure at national and international levels. It familiarizes learners with the roles of BIS, global standardization bodies, conformity assessment, and certification schemes in ensuring product safety, reliability, and market competitiveness. The subject emphasizes the integration of sustainability and UN SDGs into standardization practices, preparing students for socially and environmentally responsible engineering. Through case studies, lab exposure, and project-based learning, students gain practical skills in developing and applying standards. This knowledge equips graduates to contribute effectively to industry, research, policy, and the vision of "One Nation One Standard."

Course Outcomes:

Sr. No.	CO statement	Marks% weightage
CO-1	**Explain** the structure and functions of international, regional, and national standardization bodies, and their role in the quality ecosystem of India.	25
CO-2	**Apply** principles of standardization, conformity assessment, and certification processes in various engineering and industrial contexts.	25
CO-3	**Analyze** the role of laboratories, hallmarking, and registration schemes in ensuring quality compliance and consumer protection.	20
CO-4	**Integrate** sustainability concepts, UN Sustainable Development Goals (SDGs), and environmental considerations into the development and application of standards.	20
CO-5	**Develop** draft standards and project-based solutions aligned with BIS guidelines, demonstrating the ability to work with industry, academia, and regulatory frameworks.	10

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	Total No. of hours per Semester		ESE (E)	PA / CA (M)	PA/ CA (I)	PBL (I)	ESE (V)	
30	0	0	30	60	2	70	30	0	30	0	130

**** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.***

Content:

Sr. No.	Content	Total Hrs
1	**Quality Ecosystem in India** • **Accreditation:** 1. International Accreditation Forum (IAF) – Introduction and Structure 2. ISO/IEC 17011 -Conformity assessment — Requirements for accreditation bodies accrediting conformity assessment bodies • **International Standardization Bodies:** 1. ISO (International Organization for Standardization) 2. IEC (International Electro technical Commission) 3. ITU (International Telecommunication Union) 4. Regional Standardization 5. National Standards Bodies • **Standardization:** ISO/IEC Guide 2 - Standardization and related activities — General vocabulary	3
2	**Principles of Standardization:** Good Standardization Practices (including WTO-TBT Code of Good Practices) **Basic Concepts of Standardization:** 1. What is a STANDARD? 2. Need, Aims and Benefits of Standards 3. Types of Standards **Standardization – The Essence of Civilization:** 1. What is STANDARDIZATION? 2. History of Standardization – international level and national level 3. National Quality Ecosystem 4. BIS – The National Standards Body 5. Concept of 'One Nation One Standard' and Standard Developing Organization (SDO)	3
3	**National Standardization and Quality Ecosystem and Bureau of Indian Standards (BIS):** 1. About Bureau of Indian Standards (its establishment, roles and objectives w.r.t. standardization) 2. Overview of BIS and its activities. 3. Organizational Structure and Mandate of BIS envisaged under BIS Act **Mission Driven Standardization:** 1. Aligning standards formulation with GoI missions with relevant examples 2. INSS (Indian National Strategy for Standardization) **3.** SNAP (Standards National Action Plan) **World of Indian Standards:** 1. Standards Formulation Departments 2. Special Publications and Reference Handbooks.	3

	3. Important Publications (National Building Code, National Electrical Code, National Lighting Code **Basic Standards** 1. SI Units, Preferred Numbers, Standard Atmospheric Conditions, Limits and Fits Statistics in standardization – including sampling plans	
4	**Standardization at Bureau of Indian Standards** • **National Standardization** 1. Standardization activity at BIS (Structural hierarchy and current structure) 2. Technical Committees – constitution, appointments, roles and responsibilities 3. Standardization Process in BIS 4. Standard Formulation Process - Explanation on each stage 5. Review of Indian Standards. 6. Process Reforms in Standardization • **Important Department Specific Standards**	**3**
5	**Standards and External Trade** 1. Participation in International Standardization (ISO/IEC) 2. WTO-TBT Agreement and WTO-TBT Enquiry Point 3. CASCO (ISO committee for conformity assessment) **Conformity Assessment** 1. What is CERTIFICATION? 2. Key Pillars of Certification **Conformity Assessment at BIS** 1. Overview of BIS Conformity Assessment Schemes 2. Voluntary and Mandatory Certification 3. Quality Control Orders and their implementation 4. Product Certification Schemes 5. Overview of schemes in operation (Scheme I, II, IV, X) 6. Foreign Manufacturer's Certification Scheme 7. BIS Conformity Assessment Legal Framework ISO/IEC 17020 Conformity assessment — Requirements for the operation of various types of bodies performing inspection ISO/IEC 17040 Conformity assessment — General requirements for peer assessment of conformity assessment bodies and accreditation bodies IS/ISO 31000 Risk management – Guidelines, principles, framework and process for managing risk in the context of the recent developments in the Product Certification Scheme	**3**
6	**Laboratory Operations** 1. Basics of Laboratory Operations 2. Role of Labs in conformity assessment 3. IS/ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories a. Introduction and application in lab operations	**3**

	b. Important provisions of the standard - Management Requirements, General, Structural and Process Requirements & Accreditation and Calibration 4. Calibration & Traceability 5. Method and Equipment Validation 6. Measurement of Uncertainty **Laboratory Operations at BIS** 1. Laboratory Operations of BIS 2. BIS Testing Labs 3. Inter Laboratory Comparison and Proficiency Testing 4. Overview – including provisions in BIS Act, Rules and Regulations 5. Type of testing and Services **Laboratory Recognition Scheme (LRS)** 1. Basic Concept and Procedure Utilizing services of BIS recognized outside labs and empaneled labs	
7.	**Hallmarking Scheme of BIS** 1. Hallmarking Scheme 2. Introduction to Hallmarking Scheme of BIS 3. Procedures for licensing of Jewelers and drawl of samples 4. Recognition of Assaying and Hallmarking centers 5. Mandatory Hallmarking Order 6. Testing and Hallmarking of precious metal jewelry 7. Indian Standards (IS 1417, IS 2112, IS 1418, IS 2113, IS 15820) 8. Process of Hallmarking	**3**
8	**Registration Scheme of BIS** **Standards in Daily Life:** Faculty purview **Management Systems Certification (MSC)** 1. Principles and Basic Concepts 2. Brief Overview of MSC Schemes of BIS 3. Operation and Procedures	**3**
9	**Complaint handling** 1. Provisions for actions on non-compliance to QCOs, misuse of standard mark 2. Complaint handling mechanisms and Enforcement Activities **Sustainability: Sustainability Framework for Standardization** 1. Concept of Sustainability 2. Need for Sustainability and Role of Standards 3. United Nation Sustainable Development Goals (UN SDGs) 4. ISO Guidelines for addressing Sustainability and Climate Change in Standards	**3**

10	**Addressing Sustainability through Standards** 1. Consultative Groups on Sustainability 2. Approach to address Sustainability in Standards **BIS Institutional Mechanisms to support Standardization** 1. Project Based Approach 2. Research based standardization - R&D Projects and Action Research Projects 3. Annual Program for Standardization 4. Standardization Cells 5. State Level Committee on Standardization (SLCS) 6. Partnering with Academic Institutes 7. Manak Manthan and Manak Mantrana 8. Industry Meet 9. BIS Academia Collaboration through MoUs and its key initiatives Exercise on drafting of Indian Standard as per IS 12 - Guide for Drafting and Presentation of Indian Standards	**3**
	TOTAL	**30**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	20	20	20	10	10

R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

1. Modules on Basics of standardization, prepared by Bureau of Indian Standards, New Delhi

List of Open-Source Software/learning website:

1. www. bis.gov.in
2. https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/get_is_list_by_category/

- **List of suggested activities for Problem Based Learning: (30 hours)**

(Students taking the course to be mandatorily members of BIS Student Chapters)

Sr.no.	Activity	description	Outcome	Suggested hours
1	Case Study on Standardization in Industry	Select **one sector** relevant to the student's branch (e.g., Civil – construction materials, Mechanical – automotive components, Electrical – cables & appliances, IT – data security). Study **key Indian & international standards**, their benefits, and industry challenges.	Detailed case study report (5–7 pages) with references.	10 hrs
2	BIS Structure & Processes Research	Deep dive into the **BIS standard formulation process**: proposal, drafting, committee approval, publication, and review. Include **real examples of recently published Indian Standards**.	Flowchart with explanations & example list.	5 hrs
3	Conformity Assessment & Certification Project	Select a product under **mandatory BIS certification**. Document the full **certification process**, costs, testing requirements, and enforcement mechanisms.	Process documentation (2–3 pages) + sample forms/templates.	5 hrs
4	Laboratory Operations Exploration	Visit a **local testing/calibration lab** (or virtual tour if not feasible). Compare their operations with **ISO/IEC 17025** requirements. Include findings on equipment, calibration, traceability, and quality control.	Field visit/virtual tour report with comparison table.	5 hrs
5	Standards & Sustainability Analysis	Map **5 UN Sustainable Development Goals (SDGs)** to at least **10 Indian Standards** that contribute to them. Explain how these standards support environmental, social, and economic sustainability.	SDG–Standard mapping chart with explanations.	5 hrs
6	Drafting an Indian Standard	Using **IS 12 guidelines**, prepare a **mock standard** for an everyday or engineering-related product (e.g., water bottle, electric fan, building brick). Include scope, references, definitions, requirements, and test methods.	Draft standard document (3–4 pages).	5 hrs
7	Exposure Visit / Virtual Industry Interaction	Participate in an **exposure visit to BIS labs, hallmarking centers, or industry sites** OR attend an online BIS/ISO webinar. Prepare a learning reflection report.	Reflection report (2-3 pages) + key takeaways.	10 hrs

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