Proposed Outcome-Based Curriculum Framework for Technical Education: A NEP 2020 Aligned Model with Innovative Features for Diploma & Undergraduate Engineering Programs

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ABSTRACT

The transformation of technical education in India is witnessing a paradigm shift, driven by the National Education Policy (NEP) 2020, Outcome Based Education and Industry Revolution 4.0, which emphasize flexibility, multidisciplinary learning, employability, and lifelong learning. This paper presents a proposed Outcome-Based Curriculum (OBC) Framework designed for diploma and undergraduate engineering programs offered by technical universities and state boards. The framework aligns with NEP 2020, AICTE model curriculum, and NBA accreditation guidelines, integrating modern pedagogical innovations with comprehensive assessment mechanisms. Key features include outcome mapping, criterion-referenced assessment, experiential learning, multiple entry-exit options, and utilization of the Academic Bank of Credits (ABC). Distinctive elements, such as integration of Indian Knowledge Systems (IKS), emerging technologies, sustainable development, employability enhancement, and rubric-based evaluation highlight its relevance to the evolving 21st-century skill ecosystem. This state-of-the-art framework for curriculum offers a replicable, NEP 2020 compliant blueprint for universities and technical institutions pursuing outcome-oriented curriculum reform.

Keywords : Outcome-based education, NEP 2020, engineering curriculum, technical education, continuous assessment, academic bank of credit, experiential learning.

1. INTRODUCTION:

The evolution of technical education in India has been shaped by the twin imperatives of quality and relevance. Traditional curricula, largely content-driven and examination-oriented, have often failed to nurture employability, innovation, and lifelong experiential learning. Recognizing this, national agencies such as National Institute of Technical Teachers' Training and Research Institutes (NITTTRs), All India Council for Technical Education (AICTE), and the National Board of Accreditation (NBA) have progressively emphasized Outcome-Based Education (OBE) as the guiding philosophy for curriculum design, delivery, and assessment (AICTE, 2020; NBA, 2021). The National Education Policy (NEP) 2020 further amplifies this reform agenda by advocating flexible, multidisciplinary, and skill-integrated learning frameworks, aligned with the National Credit Framework (NCrF) and Academic Bank of Credits (ABC) (Government of India, 2020).

Within this transformative landscape, curriculum design assumes a strategic role in translating policy into practice. The proposed framework for curriculum operationalizes NEP 2020 principles through a robust mapping of program outcomes (POs), course outcomes (COs), and session outcomes (SOs), along with innovative teaching-learning and assessment schemes. It also addresses the skill requirements identified under NCrF, ensuring that graduates acquire core technical competencies, employability skills, digital literacy, critical thinking, and

lifelong learning capabilities, making them well-prepared for the evolving demands of the 21st-century workforce.

2. LITERATURE REVIEW

2.1 Outcome Based Education (OBE)

William G. Spady's original articulation of OBE (1994) emphasized starting with clearly defined learning outcomes and designing curricular pathways backward from those competencies. In engineering education, OBE stresses demonstrable attainment of knowledge, skills, and attitudes via Program Educational Objectives (PEOs), Program Outcomes (POs), and Course Outcomes (COs). Empirical studies demonstrate that OBE enhances student engagement, continuous improvement cycles, and accreditation readiness (Biggs & Tang, 2011; Washington Accord, 2013). Recent Indian investigations include Pai et al. (2022) on OBE relevance in Karnataka engineering programs, Ohatkar& Deshpande (2022) on creativity development in electronics courses, and Deshmukh (2024) on CO/PO attainment strategies. Additionally, Joshua Earnest (1997, 2024) has highlighted competency-focused curriculum design and assessment alignment, providing a framework for integrating PEOs, POs, and COs in higher education contexts.

2.2 Policy Drivers in India

In India, the NBA accreditation framework mandates measurable outcome attainment for all technical programs, while the AICTE Model Curriculum (2018; revised 2023) encourages flexible, multidisciplinary

curricula integrating internships, projects, and emerging technologies. NEP 2020 further institutionalizes these reforms, promoting multidisciplinary education, mobility via the Academic Bank of Credits (ABC), and holistic development. Research by Mishra & Sethi (2019) and Agrawal et al. (2021) demonstrates strategies for linking policy principles to curriculum design and outcome assessment.

2.3 Curriculum Design and Pedagogy

Curriculum reform success depends on embedding pedagogy, assessment, and flexibility within a coherent system (NITTTR Bhopal, 2021). Studies show that authentic assessment, project-based learning, and digital integration significantly improve learning outcomes (Kumar & Sharma, 2022; Singh, 2023; Kamerikar et al., 2019). Dr. Anju Rawlley's work (reference number is required) (MSBTE, 2023) provides in-depth analysis of assessment reforms and challenges, emphasizing the importance of structured evaluation methods within OBE frameworks. Despite these advancements, translating policy principles into practical institutional models remains challenging, reinforcing the need for a robust, scalable framework such as the one proposed in this study

3. METHODOLOGY

The development of the proposed OBC framework was carried out using a design-based research approach, integrating policy analysis, benchmarking, and expert consultation.

1.Policy Review: NEP 2020, AICTE Model Curriculum, and NBA manuals were reviewed to ensure alignment of structure, credit distribution, and assessment norms.

2.Stakeholder Consultation: Inputs were obtained from subject experts, industry partners, and faculty through workshops.

3.Curriculum Mapping: PEOs, POs, and COs were mapped using revised Bloom's taxonomy and NBA alignment models.

4.Pilot Implementation: Selected courseswere developed using the proposed framework and implemented in affiliated institutions.

5.Feedback and Validation: Structured feedback was collected from faculty and students through focus groups and surveys, and iterative refinements were made based on outcome alignment and assessment feasibility.

This methodology ensured that the resulting framework was policy-compliant, pedagogically robust, and practically implementable across diverse technical institutions as depicted through figure 1.

4. PROPOSED OUTCOME-BASED CURRICULUM FRAMEWORK

The proposed Outcome-Based Curriculum (OBC) Framework integrates the NEP 2020 vision of flexible, multidisciplinary, and experiential learning with the NBA's structured approach to outcome articulation and assessment. The framework is anchored on three design pillars: Outcome-Based Curriculum (OBC), Outcome-Based Teaching and Learning (OBTL), and Outcome-Based Assessment (OBA), which collectively ensure alignment of policy, pedagogy, and assessment practices.

4.1 Need Assessment

A comprehensive needs assessment was conducted during curriculum planning and design, involving key stakeholders such as students, faculty, alumni, and industry representatives. The insights gathered helped identify skill requirements and employment-relevant competencies. These needs were integrated into program outcomes, course outcomes, term work, micro-projects, and capstone/major projects, ensuring that learners develop skills aligned with industry expectations.
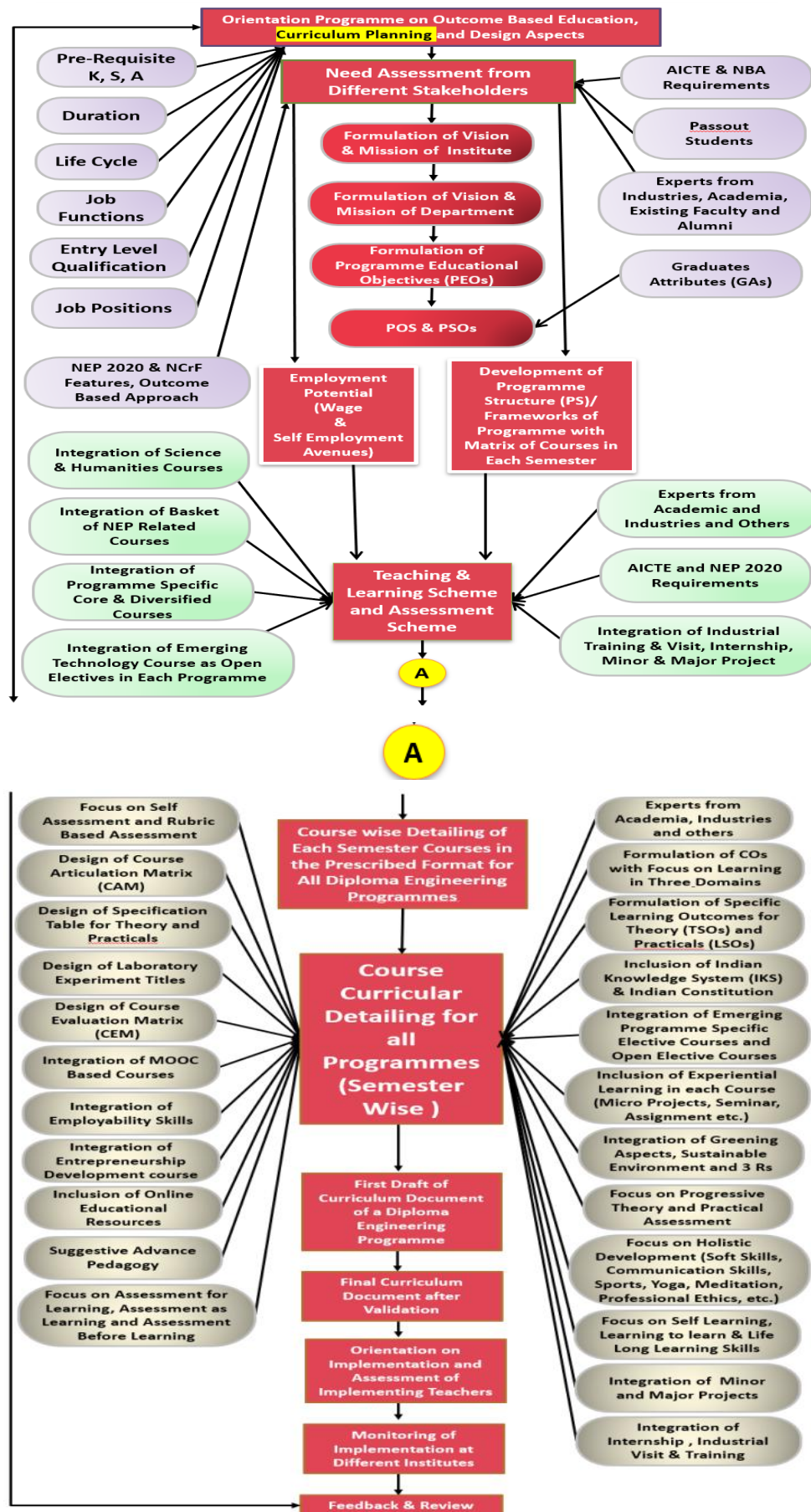
Figure 1: Approach adopted for development of Outcome Based Curriculum aligned to NEP 2020

4.2 Vision–Mission–Outcome Alignment

Each program begins with clearly articulated Vision and Mission statements, from which Program Educational Objectives (PEOs) are derived. These PEOs are systematically mapped to Program Outcomes (POs) using NBA's graduate attributes framework. Subsequently, Course Outcomes (COs) are defined for each course, ensuring vertical alignment and coherence across the curriculum.

4.3 Innovative Program Structure

The framework introduces a Teaching and Learning Scheme (TLS), combining Classroom Instruction (CI), Laboratory Instruction (LI), and Notional Hours (NH) to account for self-learning, MOOCs, assignments, and micro-projects. The assessment structure balances continuous formative evaluation, term work, and end-semester exams. Integration of general academic education, vocational training, and experiential learning is achieved through diverse course baskets aligned with the National Credit Framework (NCrF 2023).

4.4 Course-Level Design

Each course exemplifies the operationalization of the framework. It defines six COs and each CO is linked to relevant POs through a Course Articulation Matrix (CAM), ensuring measurable alignment.

The course employs:

•Progressive Theory Assessment (PTA): Quizzes, class tests, and midterms focusing on conceptual understanding and application.

•Progressive Laboratory Assessment (PLA): Rubric-based evaluation of processes and outputs in laboratory exercises.

•Term Work and Self-Learning (TWA): Micro-projects, assignments, seminars, and industrial visits.

•Course Evaluation Matrix (CEM): Specifies CO-wise weightage of assessment components.

Theory Session Outcomes (TSOs) and Lab Session Outcomes (LSOs) are linked to COs, ensuring progressive learning. Practical activities such as vernier caliper, micrometer, and autocollimator usage are evaluated using structured rubrics, promoting transparency and objectivity in assessment.

4.5 Assessment Philosophy

The framework adopts Criterion-Referenced Testing (CRT), which evaluates learners against predefined performance standards rather than relative peer comparison. Assessment is structured across multiple dimensions:

•Assessment Before Learning (Diagnostic): Identifies learners' prior knowledge and skill levels to inform instructional planning.

•Assessment for Learning (Formative): Provides ongoing feedback to support learning and guide teaching strategies.

•Assessment as Learning (Self-Reflective): Encourages learners to monitor their own progress and engage in self-directed improvement.

•Assessment of Learning (Summative): Measures achievement against course outcomes to certify competence.

Rubrics are applied consistently for evaluating projects, internships, presentations, and practical work, ensuring transparency, reliability, and constructive feedback. Additionally, the Course Evaluation Matrix (CEM) serves as a planning tool for teachers, aligning instruction, learning activities, and assessment with the weightage assigned to each course outcome.

4.6 Multidisciplinary and Flexible Curriculum

In alignment with NEP 2020, the curriculum integrates multiple course baskets to ensure holistic, flexible, and interdisciplinary learning:

•Humanities & Social Sciences (HSC): Develops critical thinking, ethical reasoning, communication, and socio-cultural awareness, fostering well-rounded graduates.

•Applied Sciences (ASC): Strengthens foundational knowledge in physics, chemistry, and mathematics essential for engineering problem-solving and scientific literacy.

•Basic Engineering (BEC): Introduces core engineering principles and practices to build a strong technical foundation.

•Basic Computing (BCC): Enhances computational thinking, programming skills, and digital literacy, crucial for Industry 4.0 readiness.

•Program Core (PCC): Focuses on essential technical knowledge and skills specific to the chosen discipline, supporting discipline-based accreditation requirements.

•Program Elective (PEC): Offers flexibility to explore advanced or specialized topics within the discipline, aligning with NEP's emphasis on multidisciplinary exposure.

•Open Elective (OEC): Encourages cross-disciplinary learning and individual interests, promoting lifelong learning and employability.

•NEP-Related Courses (NRC): Integrates Indian Knowledge Systems, sustainability, ethics, and 21st-century skill development to fulfill NEP 2020 objectives and support NBA/AICTE accreditation outcomes.

This multidisciplinary structure promotes flexibility, allows multiple entry–exit options, fosters holistic development, and equips learners with both disciplinary expertise and broad-based competencies required for the modern workforce.

4.7 Elements of the Proposed Framework

A)Course Code: Unique identifier for the course.

B)Course Title: Name of the course.

C)Pre-requisite Course(s): Courses students must complete before taking this course.

D)Rationale: Purpose of the course, relevance to industry, skills developed, and link to NEP 2020 and accreditation requirements.

E)Course Outcomes (COs): Specific competencies learners should achieve across cognitive, psychomotor, and affective domains.

F)Course Articulation Matrix (CAM): Mapping of COs to Program Outcomes (POs) and Program Educational Objectives (PEOs).

G)Teaching& Learning Scheme (TLS): Structure of theory, lab, self-learning, MOOCs, and other learning hours.

H)Assessment Scheme: Methods for evaluating CO attainment (theory, lab, term work, microprojects, self-learning).

I)Course Curriculum Detailing: Mapping of session-level outcomes (TSOs & LSOs) to COs; integration of NEP 2020 themes like sustainability, IKS, and multidisciplinary learning.

J)Theory Session Outcomes (TSOs) & Units: Expected learning outcomes for each theory session/unit.

K)Laboratory Session Outcomes (LSOs) & List of Practicals: Practical skills and lab exercises linked to COs.

L)Term Work & Self-Learning Activities: Assignments, micro-projects, seminars, industrial visits, and self-study tasks.

M)Course Evaluation Matrix (CEM): Weightage distribution across theory, lab, term work, and self-learning to measure CO attainment.

N)End-Semester Theory Assessment Table: Distribution of cognitive domain assessment across units/COs.

O)Laboratory Assessment Table: Structured evaluation of lab exercises aligned to LSOs and COs.

P)Instructional/Implementation Strategies: Recommended teaching methods (lectures, tutorials, flipped learning, industry visits, ICT tools, case studies).

Q)Major Laboratory Equipment, Tools & Software: List of required instruments, tools, and software for practical sessions.

R)Learning Resources:

a.Books with authors, publisher, and ISBN

b.Lab manuals, guides, manufacturer manuals, learning packages

c.Online or MOOC resources (if applicable)

S)Curriculum Development Team: Names of faculty/experts responsible for design, validation, and implementation.

5. UNIQUE FEATURES OF THE FRAMEWORK

The proposed Outcome-Based Curriculum (OBC) framework is designed to holistically integrate NEP 2020 principles, modern pedagogy, and assessment best practices. Its distinctive features, along with their relevance to the current educational scenario, are summarized below:

•NEP 2020 & NBA Alignment: The curriculum is fully compliant with NEP 2020 and NBA accreditation standards, ensuring flexible, multidisciplinary, and outcome-oriented education that supports institutional compliance and skill-driven learning.

•InnovativeProgramme Structure: Integration of Teaching & Learning Scheme (TLS) with theory, lab, term work, and notional hours, with multidisciplinary course baskets embedded, encourages experiential, hands-on learning aligned with NEP's emphasis on applied knowledge and life-long learning.

•Multidisciplinary Learning: Students can select courses across streams, creating personalized learning pathways and supporting NEP's vision of breaking disciplinary silos for holistic education.

•Assessment Philosophy: Emphasis on formative, diagnostic, and self-reflective assessments using rubrics (Assessment for, as, and before learning). Criterion-Referenced Testing ensures objective evaluation, moving away from high-stakes exams toward continuous learning as promoted by NEP 2020.

•Experiential Learning: Incorporates microprojects, seminars, internships, industrial training, and major projects to prepare students for real-world challenges, fostering innovation and employability in line with NEP objectives.

•Flexibility& Choice: Open electives, NEP-related courses, and program-specific electives allow students to align learning with interests and career goals, encouraging self-directed learning as emphasized in NEP 2020.

•Learning to Learn & Lifelong Learning: MOOCs, self-learning modules, and digital resources enhance independent learning skills, supporting the NEP's lifelong learning approach.

•Academic Bank of Credits (ABC): Enables credit transfer, flexible entry/exit points, and modular learning, aligning with NEP 2020's flexible pathways and mobility across programs and institutions.

•Multipoint Entry & Exit: Recognition of prior learning allows certification at multiple stages, accommodating diverse student needs as envisaged by NEP 2020.

•Ethics, Values & Constitution: Courses on ethics, values, and Indian Constitution promote cultural awareness, responsible citizenship, and holistic development.

•Indian Knowledge Systems (IKS): Traditional knowledge is integrated with modern curricula, strengthening the connection to India's heritage and culture in line with NEP 2020.

•Entrepreneurship& Emerging Technologies: Dedicated courses on startups, AI, IoT, EVs, Robotics, and Industrial Automation prepare students for future jobs and industry 4.0 requirements, supporting NEP's skill-driven focus.

•Green and Sustainable Environment: Courses on renewable energy, sustainability, and environmental education foster awareness and responsible engineering practices in line with NEP 2020 goals.

•Holistic Development: Sports, yoga, and wellness courses promote physical, mental, and emotional health, reflecting NEP's focus on overall student well-being.

•ICT& Digital Skills: Programming, IT fundamentals, and LMS-enabled blended learning promote digital literacy and online learning as envisioned in NEP 2020.

•Employability& Career Readiness: Integration of microprojects, internships, seminars, and industry visits enhances skill-based employability, supporting NEP's goal of future-ready graduates.

•Project-Based Learning (PBL): Micro, minor, and major projects cultivate problem-solving, critical thinking, and innovation, aligning with NEP 2020's emphasis on experiential learning.

•Specific Learning Outcomes: COs, POs, TSOs, and LSOs ensure measurable learning at all levels, enabling transparency and accountability in line with NEP 2020.

•Soft Skills & Management Skills: Communication, collaboration, finance, and managerial skills are embedded to develop holistic competencies for career readiness.

•Dynamic Curriculum & Research Orientation: Regular updates, IPR awareness, and research-based projects foster innovation and adaptability, preparing students for emerging challenges as advocated by NEP 2020.

The proposed Outcome-Based Curriculum framework offers several unique advantages over traditional curricula, making it essential for the current skill and employability landscape. Unlike conventional content-driven, examination-focused programs, this framework emphasizes competency-based, outcome-oriented learning, ensuring students acquire the skills required by modern industries. Its multidisciplinary and flexible structure allows learners to explore courses across streams, promoting adaptability in a rapidly evolving job market. Experiential learning through projects, internships, seminar, augmented experiments and industrial exposure equips students with practical problem-solving abilities, while Criterion-Referenced Testing (CRT) and rubrics provide objective, transparent, and continuous assessment. The integration of soft skills, ethics, Basics of finance, Indian Knowledge Systems, and holistic development prepares students not only technically but also socially and culturally for professional challenges. Inclusion of emerging technologies, green skills, and project-based learning aligns graduates with Industry 4.0 requirements and sustainability demands. Flexible entry-exit options, MOOCs, self-learning modules, and the Academic Bank of Credits facilitate lifelong learning and career mobility. Overall, this framework ensures students are not only job-ready but capable of innovation, critical thinking, and adapting to dynamic skill requirements, bridging the gap between academic knowledge and real-world professional competence.

6. DISCUSSION AND ANALYSIS

6.1 Comparison with Conventional Curricula

Traditional curricula largely focused on theoretical instruction and high-stakes examinations, providing limited practical exposure, flexibility, and student autonomy. In contrast, the proposed Outcome-Based Curriculum (OBC) framework operationalizes a learner-centric model with continuous assessment, experiential learning, and clear outcome mapping, effectively bridging academic knowledge with employability and industry-ready skills.

6.2 Impact on Learning and Assessment

The integration of formative assessments, rubrics, and criterion-referenced testing enhances transparency, accountability, and clarity in learning outcomes. Pilot implementation revealed higher student engagement, improved understanding of course objectives, and more consistent attainment of program outcomes. Faculty reported that structured feedback mechanisms facilitated iterative improvement in both teaching and learning processes.

6.3 Institutional and Policy Implications

The framework offers a scalable, adaptable model for state boards and universities seeking NEP 2020 compliance. Successful implementation requires targeted faculty development in OBE principles, digital pedagogy, and innovative assessment strategies. Institutions like NITTTRs can play a critical role in capacity-building, providing structured training programs and supporting systemic curriculum reforms.

6.4 Challenges and Future Directions

The implementation of NEP 2020 necessitates a holistic transformation of India's higher education ecosystem through reforms in pedagogy, curriculum, research, infrastructure, and governance. Faculty must transition from traditional lecture-based methods to learner-centric, outcome-based, and experiential pedagogies supported by ICT integration, problem-based learning, and continuous professional development. Upgrading infrastructure with modern laboratories, ICT-enabled classrooms, and online learning systems is essential for equitable access and quality enhancement. Strengthening research and innovation through interdisciplinary projects, industry collaboration, and Centers of Excellence will foster creativity and problem-solving. Curriculum reforms must align with NEP's vision by incorporating flexibility, multidisciplinary learning, vocational integration, and emerging technologies such as AI, IoT, and robotics. A focus on inclusive and global education, along with international collaboration, accreditation, and global mobility, will ensure social equity and global recognition.

Further, NEP 2020 emphasizes the need for robust assessment reforms, replacing exam-oriented methods with continuous, formative, and competency-based evaluation supported by rubrics, portfolios, and AI-driven tools. Integrating sustainability, Indian Knowledge Systems (IKS), ethics, and green education within the curriculum fosters responsible and holistic learners. Financial and resource investment by central and state governments must prioritize faculty training, research, infrastructure, and support for disadvantaged groups, ensuring effective implementation and accountability through good governance. Digital enablement via LMS, MOOCs, and AI tools can personalize learning and

improve accessibility, while entrepreneurship, internships, and experiential projects enhance employability and innovation. Continuous monitoring and feedback involving stakeholders will sustain curriculum relevance, align education with dynamic skill needs, and build a future-ready higher education system capable of driving national development. The Issues and possible strategies to be adopted are depicted through Table 1.

Table 1: Challenges and suggested strategies

S.N.	Issues/ Challenges	Strategies
1	Pedagogical Challenges	Faculty training and development in pedagogical aspect of T-L Adapting to new teaching methodologies
2	Infrastructural Challenges	Upgrading existing facilities Incorporating technology in education Optimal Learning Environments and Support for students Laboratory Development, ICT based Teaching and Learning, Hi- Tech classrooms/ laboratories/ studios Support ODL and blended T-L Access by each learner
3	Research and Innovation	Promotion of interdisciplinary research related to problems of industries in the form of projects Encouraging collaboration with industries through Triple Helix Model
4	Faculty & Staff Training	Investment in staff development
5	Inclusive Education	Addressing the needs of diverse student populations Fostering social equity and inclusion
6	Globalization and Internationalization Global Mobility	Collaborative Programmes/Internship Attracting international students and faculty Establishing global partnerships Need for accreditation of all programmes for global mobility
7	Policy Recommendations Review	Suggestions for policy refinement based on deliberation/ research findings based on NEP 2020 implementation
8	Exam Oriented Teaching-Learning and Assessment	More practical oriented/ skill based / problem based/ project based teaching learning Continuous and comprehensive development & assessment Ensuring outcomes attainment development continuously
9	Curriculum Reforms	Design of NEP aligned flexible multi disciplinary Outcome Based Curriculum integrating emerging technology courses with multi prong flexibility Design of model curriculum at different levels, at apex level
10	Assessment Reforms	Focus on Formative Assessment rather than Summative Assessment. Use of rubric for Teaching & Learning, Assessment, Self Assessment, Project Based Learning and Assessment Shift to Portfolio Based Assessment/ Outcome Based Assessment rather

		than only percentage/ grades One nation, one exam concept, instead of multiple entrance examination for different types of degree/ diploma, etc. Assessment platforms need to be created for technology based large scale assessment in each institution Use of AI based assessment tools			Using hub and spoke model for integration of 3 silos of NCrF
11	Quality Universities and Colleges: A New and Forward-looking Vision for India's Higher Education System	Efficient, effective and visionary leadership Motivated, energized and capable faculty Teacher Education	14	Towards a More Holistic and Multidisciplinary Education	Design of multidisciplinary Outcome Based Curriculum Development at all levels integrating value based courses Arranging co-curricular activity
12	Institutional Restructuring and Consolidation	Formulation of policy for creating MERU Formulation of policy for converting affiliated colleges into autonomous degree granting institutions Providing directions/actions to be taken by existing institutions	15	Substantial increase in public investment in education by both the Central government and all State Governments.	Budgetary provision for efficient implementation of NEP Financial support should be provided to various critical elements and components of education, such as ensuring universal access, learning resources, nutritional support, matters of student safety and well-being, adequate numbers of teachers and staff, teacher development, and support for all key initiatives towards equitable high-quality education for underprivileged and socioeconomically disadvantaged groups. Good Financial Governance
13	Re-imagining Vocational Education	Integrating vocational education with main stream higher education Vocationalization of Higher education Mapping industry requirement with new programmes to be started Orientation training for linkages among different levels/ qualification Establishing pathways for horizontal and vertical mobility amongst the NHEQF and NSQF Integrating Experiential Learning	16	Allocation of Resources	Timely infusion of requisite resources - human, infrastructural, and financial - at the Central and State levels will be crucial for the satisfactory execution of the Policy.
			17	Good Governance	Mechanism of performance based

		funding to States / HEIs may be devised. Efficient mechanism will be ensured for the optimal allocation and utilization of funds earmarked for different elements. Mechanisms for good governance of all institutions, public and priate	24	MERU	Design and implementing interest/ hobby courses for the same with credit/ non-credit provisions Development and implementation of comprehensive curriculum	
18	Monitoring and Review	Yearly joint reviews of the progress of implementation of the policy	25	Happy and Enthusiastic Teachers	Faculty will be appointed to individual institutions and not to be transferred across institutions to ensure their commitmentforinstitution and community. Freedom to adopt innovative pedagogical approaches, prepare learning, assignments etc. Assessment during T-L. Empowering the faculty to conduct innovative teaching, research, and services. Provision of rewards, promotions, recognitions, and movement into institutional leadership as incentive for excellent performance. Provision of professional development allowances for faculty for their development	
19	Academic Bank of Credit (ABC)	Need to create provision for enthusiastic and fast learner for earning additional credits				
20	Promotion of Indian Languages for Teaching- Learning & Assessment	Need to create e-contents, videos, quiz and assignments in all regional languages to provide access to enthusiastic learners				
21	Access and equity to education	Need to create infrastructural facility for technology enabled education/ online and digital education for weaker section, distant learners, persons with disabilities by equitable use of technology Creating Optimal Learning Environments and Support System for students				
			26	Flexibility for lifelong learning	Creating multi entry and multi exit options in the programme structure with award of certification	
22	Internships/Industrial Training	Integration of on the job training (OJT) through Internships/Industrial Training in each programme structure	27	Recognition of prior learning	Provision of credit transfer by establishing equivalence	
23	Student-Teacher Ratios	Large scale recruitment				

28	HECI	Effective collaboration between various stakeholders
		Networking of multiple bodies (AICTE, UGC) in a synchronized and systematic manner
		MHRD, CABE, Union and State Governments, education-related Ministries, State Departments of Education, Boards, NTA, the regulatory bodies of higher education and HEIs
		Demarcation of roles of different agencies under HECI
29	Limited institutional autonomy	Academic, financial and administrative autonomy to the institutions based on performance
30	Overlapping Roles of Different Agencies/Organisation	Framework with specific roles of different agencies for horizontal and vertical growth/mobility of learner need to be created

7. CONCLUSION

The proposed Outcome-Based Curriculum (OBC) framework offers a transformative, learner-centric approach to technical education, fully aligned with NEP 2020 and NBA accreditation requirements. By integrating flexible, multidisciplinary course structures, experiential learning, and criterion-referenced assessments, it overcomes the limitations of traditional, content-driven curricula, bridging gaps in employability, practical skills, and lifelong learning. The systematic mapping of Program Educational Objectives (PEOs), Program Outcomes (POs), and Course Outcomes (COs), coupled with innovative teaching–learning strategies, ensures measurable, transparent, and verifiable learning outcomes.

The framework also embeds essential 21st-century competencies, including digital literacy, entrepreneurship, sustainability, ethics, and social responsibility, while enabling mobility and credit transfer through the Academic Bank of Credits (ABC). Its holistic design encourages critical thinking, creativity, and problem-solving, preparing students to respond effectively to evolving industry and societal demands.

Although implementation challenges such as faculty training, infrastructure enhancement, and assessment standardization exist, these can be mitigated through institutional capacity-building and policy support. Overall, the framework provides a scalable and replicable model for technical institutions across India, demonstrating a practical pathway to operationalize NEP 2020 principles. By fostering engaged, skilled, and ethically aware graduates, it strengthens India's vision for a modern, outcome-oriented, and globally competitive technical education ecosystem.

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