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Impact of NEP 2020 on Curriculum Structure and Learning Outcomes of B.Tech Civil Engineering at Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

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Abstract- National Education Policy (NEP) 2020 has brought a major transformation in the Indian higher education system, especially in technical education like B.Tech Civil Engineering. This research paper focuses on analysing the impact of NEP 2020 on curriculum structure and learning outcomes at Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. The study compares the old Choice Based Credit System (CBCS) syllabus with the newly implemented NEP-based curriculum. It highlights the introduction of multidisciplinary subjects, skill-based learning, modern technological courses such as Python programming, Artificial Neural Networks, Internet of Things, and research-oriented subjects like Research Methodology. The study also includes value-based subjects such as Fundamentals of Vastushastra, Constitution of India, and Community Project, which promote ethical and social responsibility among students. The findings indicate that NEP 2020 has significantly improved curriculum flexibility, practical exposure, employability, and overall learning outcomes. It has shifted the focus from theoretical knowledge to skill development, innovation, and industry readiness, thereby preparing students for modern engineering challenges.

Keywords: NEP 2020, Civil Engineering, CBCS, Curriculum Structure, Learning Outcomes, RTMNU, Skill Development, Multidisciplinary Education, Outcome-Based Education.

I. INTRODUCTION

Education is the backbone of national development, and in a developing country like India, reforms in education play a very important role in shaping the future of students and society. The introduction of National Education Policy (NEP) 2020 is considered a revolutionary step in transforming the traditional education system into a modern, flexible, and skill-oriented system. This policy aims to provide holistic, multidisciplinary, and student-centric education, focusing on both knowledge and skill development. In the field of engineering education, particularly in B.Tech Civil Engineering, NEP 2020 has introduced significant changes in curriculum structure and teaching-learning processes. Earlier, under the Choice Based Credit System (CBCS), the curriculum was mainly rigid and theory-oriented. Although some flexibility was provided through electives, the overall system lacked practical exposure, interdisciplinary learning, and industry relevance. At Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, the implementation of NEP 2020 has led to a complete restructuring of the Civil Engineering curriculum. The new curriculum focuses on multidisciplinary education, skill development, research orientation, and integration of modern technologies.

One of the most important features of NEP 2020 is the introduction of flexibility in curriculum through Academic Bank of Credits (ABC) and multiple entry and exit systems. Students can now choose subjects from different disciplines and can also exit the course at different stages with appropriate certification. This system reduces academic pressure and increases accessibility. Another key aspect of NEP 2020 is the emphasis on practical and experiential learning. Civil Engineering students are now encouraged to participate in internships, field visits, community projects, and real-life problem-solving activities. This helps them to understand the practical application of theoretical concepts. The inclusion of new subjects such as Fundamentals of Vastushastra, Computer Programming using Python, Entrepreneurship in Civil Engineering, Constitution of India, Civil Engineering Report Writing, Artificial Neural Networks, Internet of Things, Cyber Ethics and Law, Research Methodology, and Electrical Power System has significantly enriched the curriculum.

These subjects were not part of the earlier CBCS system and have been introduced to make students industry-ready and future-oriented. Thus, NEP 2020 has shifted the focus of engineering education from traditional rote learning to skill-based, innovative, and outcome-based learning, which is essential in today's rapidly changing technological world.

II. LITERATURE REVIEW

Various researchers and academicians have studied the impact of NEP 2020 on higher education and engineering curriculum. The literature indicates that NEP 2020 has introduced significant reforms aimed at improving the quality, accessibility, and relevance of education. Many studies highlight that NEP 2020 promotes multidisciplinary learning, which allows engineering students to explore subjects beyond their core domain. This helps in developing a broader perspective and enhances creativity and innovation. Researchers have also emphasized that the policy reduces the burden of rigid curriculum and introduces flexibility through credit-based systems. Several research papers have discussed the importance of skill-based education under NEP 2020. It is observed that the inclusion of practical subjects, internships, and project-based learning improves the employability of students. Engineering graduates are now better prepared to meet industry requirements due to hands-on experience and exposure to real-world problems. Studies also indicate that the integration of modern technologies such as Artificial Intelligence, Internet of Things, and programming languages like Python into engineering curriculum is a major advantage of NEP 2020. These technologies are essential for the development of smart infrastructure and sustainable engineering solutions. Some researchers have pointed out the importance of introducing value-based education through subjects like Constitution of India and community-based projects. These subjects help in developing ethical values, social responsibility, and awareness among students. Research on curriculum comparison shows that the earlier CBCS system was limited in terms of flexibility and interdisciplinary learning. In contrast, NEP 2020 provides a more dynamic and adaptable curriculum structure that supports lifelong learning. The literature also highlights the role of research methodology in engineering education. NEP 2020 encourages students to engage in research activities, which improves analytical thinking and innovation capabilities.

According to **Vhanne et al. (2025)**, the implementation of NEP 2020 has brought a significant transformation in the curriculum structure of higher education, focusing on holistic development, multidisciplinary learning, and flexibility in education. Their study conducted on 100 first-year B.Com students at the University of Mumbai using a mixed-method approach revealed that the restructured curriculum under NEP 2020 positively impacts students' cognitive development by enhancing critical thinking and problem-solving abilities. The findings also indicate that student engagement has improved due to interactive teaching-learning methods and reduced dependence on rote learning. Furthermore, the study highlights that NEP 2020 supports emotional and social development by encouraging adaptability, communication, and collaborative learning among students. However, the research also identifies certain challenges such as lack of adequate resources and varying levels of teacher preparedness, which may affect effective implementation. Overall, the study concludes that NEP 2020 has a positive impact on curriculum design and student development, but continuous support, training, and infrastructure improvement are required to fully achieve its objectives.

According to **Ashokkumar et al. (2025)**, NEP 2020 represents a major transformation in India's education system by aligning it with global educational trends and focusing on competency-based and experiential learning approaches. The study provides a comprehensive review of the policy and highlights that NEP 2020 aims to improve student learning outcomes, teacher training, and educational infrastructure by promoting quality, equity, and innovation in higher education. The findings indicate that the policy encourages skill development, critical thinking, and practical learning, which are essential for meeting the demands of the 21st century. It also emphasizes the importance of modern teaching methodologies and continuous assessment to enhance overall student performance. However, the study identifies several challenges in implementation, including resource limitations, administrative issues, and resistance to change within institutions. Despite these challenges, the research concludes that NEP 2020 has strong potential to bring transformational change in the Indian education system, provided that it is effectively implemented with proper planning, institutional support, and continuous monitoring.

According to **Priya et al. (2025)**, NEP 2020 plays a crucial role in transforming India's education system by introducing flexibility in curriculum, which acts as a catalyst for multidisciplinary learning and supports the vision of Viksit Bharat@2047.

The study highlights that initiatives such as Academic Bank of Credits (ABC), Multiple Entry-Exit system, and transdisciplinary course structures allow students to design their own educational pathways based on their interests, skills, and career goals. The findings reveal that such flexibility promotes creativity, critical thinking, and lifelong learning among students, aligning Indian education with global standards. The research further emphasizes that NEP 2020 helps in developing a skilled, adaptable, and knowledge-based workforce. However, the study also identifies challenges such as lack of faculty training, institutional readiness, infrastructure limitations, and resistance to change from traditional teaching methods. Overall, the study concludes that curriculum flexibility under NEP 2020 has a positive impact on higher education, but effective implementation requires continuous institutional support, policy adaptation, and capacity building.

According to **Bhardwaj et al. (2024)**, NEP 2020 plays a crucial role in strengthening the curriculum framework of the Indian education system by emphasizing flexibility, quality, inclusiveness, and outcome-based learning. The study highlights that the policy promotes learner-centric education, which focuses on developing critical thinking, creativity, and problem-solving skills while reducing the dependence on rote learning methods. The findings suggest that an effective curriculum under NEP 2020 integrates both traditional Indian knowledge systems and modern educational theories, thereby creating a balanced and enriched learning environment. The research also explains that NEP 2020 connects various curriculum perspectives and encourages the adoption of innovative teaching practices to improve learning outcomes. Overall, the study concludes that NEP 2020 has a strong positive impact on curriculum design by making it more dynamic, culturally rooted, and aligned with global educational standards, which ultimately enhances the overall quality of education in India.

According to **Das (2024)**, NEP 2020 represents a major reform in India's education system by introducing a holistic, flexible, and multidisciplinary approach aimed at improving accessibility, equity, and quality of education. The study highlights that the policy shifts the focus from content-based learning to a learning-centered approach, which promotes critical thinking, creativity, and overall development of students. The findings indicate that NEP 2020 introduces significant structural changes such as flexible curriculum, multiple entry-exit system, and emphasis on vocational and skill-based education, especially in higher education. It also emphasizes the role of technology and digital learning in bridging educational gaps and improving access across rural and urban areas. Furthermore, the establishment of the National Research Foundation (NRF) is identified as a key step toward strengthening research and innovation culture in India. However, the study also points out challenges such as lack of infrastructure, need for teacher training, and financial constraints in implementation. Overall, the research concludes that NEP 2020 has strong potential to transform the Indian education system into a globally competitive, inclusive, and knowledge-driven system, provided that effective implementation strategies are adopted.

III. COMPARATIVE ANALYSIS OF CBCS AND NEP 2020 CURRICULUM

The comparison between old CBCS syllabus and new NEP 2020 curriculum shows significant differences in structure, approach, and outcomes. Under CBCS, the curriculum was mainly focused on core engineering subjects with limited electives and less interdisciplinary exposure. The system was more theory-based and less focused on skill development. In contrast, NEP 2020 introduces a flexible and multidisciplinary curriculum with a strong focus on practical learning and modern technologies.

New Subjects Introduced under NEP 2020

The following important subjects have been added:

- Fundamentals of Vastushastra
- Computer Programming using Python
- Entrepreneurship in Civil Engineering
- Constitution of India
- Civil Engineering Report Writing
- Community Project

- Artificial Neural Networks
- Internet of Things
- Cyber Ethics and Law
- Research Methodology
- Electrical Power System

These subjects play a very important role in improving the overall quality of education.

The introduction of new subjects under NEP 2020 in B.Tech Civil Engineering has provided multiple academic, practical, and professional benefits to students by enhancing their overall knowledge, skills, and employability. [1] **Fundamentals of Vastushastra** helps students understand traditional Indian architectural principles and their application in modern sustainable design, thereby integrating cultural knowledge with engineering practices. [2] **Computer Programming using Python** develops computational thinking, coding skills, and data analysis ability, which are useful in structural design, modeling, and automation. [3] **Entrepreneurship in Civil Engineering** promotes innovative thinking, business development skills, and startup culture, encouraging students to become self-employed and job creators. [4] **Constitution of India** creates awareness about legal rights, duties, governance, and ethical responsibilities, which are essential for professional engineers. [5] **Civil Engineering Report Writing** improves technical communication, documentation, and presentation skills required for preparing reports, project proposals, and research papers. [6] **Community Project** provides real-life exposure to societal issues, helping students develop teamwork, leadership, and problem-solving abilities while contributing to community development. [7] **Artificial Neural Networks (ANN)** introduces students to machine learning techniques used in prediction, optimization, and analysis in civil engineering fields such as traffic flow, structural health monitoring, and environmental systems. [8] **Internet of Things (IoT)** enables understanding of smart technologies used in smart cities, infrastructure monitoring, and automated systems, making students future-ready. [9] **Cyber Ethics and Law** educates students about digital security, data protection, and ethical use of technology in professional practice. [10] **Research Methodology** enhances analytical thinking, research skills, and the ability to conduct experiments and publish technical work. [11] **Electrical Power System** provides basic knowledge of power generation, transmission, and distribution, which is important for integrating civil engineering projects with electrical infrastructure. Overall, these subjects collectively ensure holistic development by improving technical competence, practical skills, ethical awareness, research capability, and industry readiness of Civil Engineering students.

Major Differences

- CBCS was rigid, NEP is flexible
- CBCS focused on theory, NEP focuses on skills
- CBCS had limited technology exposure, NEP includes AI, IoT, Python
- CBCS had less research focus, NEP promotes innovation
- CBCS lacked value education, NEP includes ethics and social responsibility

IV. IMPACT ON LEARNING OUTCOMES

The implementation of NEP 2020 has brought a significant and positive transformation in the learning outcomes of Civil Engineering students by shifting the focus from traditional theoretical learning to a more practical, skill-based, and multidisciplinary approach. Under the new curriculum, students are now actively involved in project-based learning, fieldwork, internships, and community engagement activities, which provide them with real-life exposure and help in better understanding of engineering concepts. The inclusion of modern subjects such as Computer Programming using Python, Artificial Neural Networks, and Internet of Things has enhanced students' computational and technological skills, enabling them to work on advanced applications like smart infrastructure, data analysis, and automation in construction practices.

At the same time, subjects like Entrepreneurship in Civil Engineering motivate students to think innovatively and develop a startup mindset, encouraging them to become job creators rather than job seekers. The introduction of Research Methodology has strengthened students' ability to conduct research, analyze data, and prepare technical papers, which is highly beneficial for higher studies and professional growth. Additionally, value-based subjects such as Constitution of India, Cyber Ethics and Law, and Community Project have contributed to the development of ethical values, social responsibility, and awareness about the role of engineers in society. Communication-oriented subjects like Civil Engineering Report Writing have improved students' technical writing and presentation skills, which are essential in professional practice. Furthermore, interdisciplinary subjects like Electrical Power System have broadened their knowledge beyond core civil engineering, helping them understand integrated infrastructure systems. Overall, NEP 2020 has led to the holistic development of students by improving their technical competence, practical skills, critical thinking ability, communication skills, and ethical understanding, making them more confident, industry-ready, and capable of addressing modern engineering challenges effectively.

CONCLUSION

The present study clearly concludes that the implementation of NEP 2020 has brought a remarkable and transformative change in the curriculum structure and learning outcomes of B.Tech Civil Engineering at Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. The comparison between the traditional CBCS system and the newly introduced NEP-based curriculum shows a clear shift from a rigid, theory-oriented approach to a flexible, multidisciplinary, and skill-based education system. The inclusion of modern technological subjects such as Computer Programming using Python, Artificial Neural Networks, and Internet of Things has significantly enhanced students' technical and computational abilities, making them capable of adapting to emerging trends like smart cities and digital construction. At the same time, subjects like Entrepreneurship in Civil Engineering have encouraged innovation, self-employment, and startup culture among students. The introduction of Research Methodology has strengthened analytical thinking and research capabilities, while value-based subjects such as Constitution of India, Cyber Ethics and Law, Fundamentals of Vastushastra, and Community Project have contributed to the development of ethical values, social awareness, and understanding of Indian knowledge systems. Furthermore, communication-focused subjects like Civil Engineering Report Writing have improved students' professional and documentation skills, which are essential in engineering practice.

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