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Challenges and Opportunities to Address the Crisis in Core Engineering Education

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Abstract—In recent years, several crucial engineering fields, such as civil engineering, mechanical engineering, and electrical engineering, have experienced a decline. This decline can be attributed to intensified global competition, particularly from countries with burgeoning engineering sectors. This situation raises concerns about the future availability of skilled engineers across various industries. Simultaneously, professions like computer science and data science are increasingly viewed as more lucrative and promising, enticing students away from traditional engineering paths. To address these challenges, government intervention is imperative. Measures should include enhancing the image and attractiveness of core engineering disciplines, promoting diversity and inclusion, and aligning curricula with evolving industry demands. The rapid pace of technological advancement has given rise to new interdisciplinary fields and specialties, further diverting students from traditional engineering subjects. This poses a challenge in maintaining the relevance and appeal of foundational engineering disciplines. This paper aims to analyze admission and placement data in core engineering versus computer science departments to shed light on these trends.

Keywords—Core Engineering, Crisis in Core Engineering, Challenges, Opportunities

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1. Introduction

Engineering education has long been considered the foundation of technological progress, innovation, and economic growth .It gives people the skills and knowledge they need to design create, and improve the world around us. However, in recent years there has been growing concern about a crisis in core engineering education.

This crisis encompasses several challenges that threaten the effectiveness and relevance of engineering curriculum in meeting the demands of a rapidly changing world.

The rapid pace of technological progress, globalization, and new industry needs are putting significant pressure on engineering education institutions to adapt and stay relevant. In this paper, we will explore the main challenges facing core engineering education and the potential opportunities that can be used to address these challenges . Some are:

Lack of diversity: In terms of gender, race, and socioeconomic background, core engineering specialties frequently experience a lack of variety. The absence of diversity in these sectors limits the perspectives and talent pool.

Rapid technological breakthroughs have resulted in the emergence of new multidisciplinary fields and specialties, which are luring students away from conventional core engineering subjects .

This can make it difficult to keep key engineering disciplines relevant and appealing.

Increased global competition, particularly from nations with burgeoning engineering industries, offers problems for fundamental engineering disciplines in terms of keeping competitive and inventive

Many fundamental engineering specialties are facing an aging workforce, with a considerable proportion of senior engineers nearing retirement. This raises issues regarding knowledge and skill transmission to the following generation.

Student enrollment in many basic engineering specialties, such as civil engineering and mechanical engineering, has been declining in recent years.

Career choices are shifting: Students are increasingly drawn to other subjects, such as computer science and data science, which are regarded to be more profitable or offer better job prospects. This shift in career interests has contributed to a drop in enrollment in key engineering fields.

To address these difficulties, educational institutions, businesses, and policymakers must work together to improve the perception and appeal of fundamental engineering disciplines, boost diversity and inclusion, and ensure the curriculum remains aligned with developing needs.

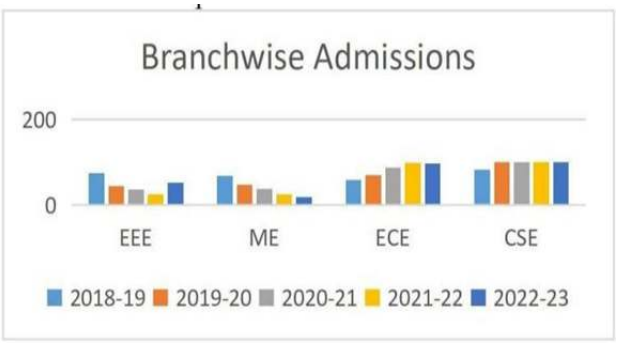

Fig. 1 : 5 Years Admission Data Statistics at HITAM College

2. Challenges And Opportunities

The fig 1 shows 5 consecutive years of student admissions data from the departments (EEE, ME, ECE, CSE) at the Hyderabad Institute of Technology and Management.

Fig. 1. 5 Years Admission Data Statistics at HITAM CollegeFrom 2018 to 2023, students enrolling in computer science enhanced very much depending on mainly students' and parents' perspectives, that their ward will get a placement during their Under graduation.The above figure represents the percentage of students who opted for Computer Science Engineering compared to Electrical and Mechanical Engineering as well as Electronics and communication department.

According to the NASSCOM 2023 report, the following branches of engineering are facing the highest unemployment rates:

- Civil engineering
- Mechanical engineering
- Electrical engineering
- Electronics and telecommunications engineering
- Chemical engineering

In India, there is a 21% unemployment rate for engineering graduates. However, graduates in these five branches have an even greater unemployment rate, ranging from 25% to 30%.

The factors contributing to the high unemployment rate in these branches are intricate and varied. But some of the more important ones are as follows:

- Due to automation and technological improvements, these branches have a shrinking need for graduates.
- Since there is little interaction between the business

Payable Salary Statistics For Various Fields As Per Nasscom 2023.

The National Association of Software and Service Companies, or NASSCOM for short, is a well-known trade organization in India's technology and IT-enabled services industry. The group is essential in helping to develop legislation, support industry growth, and advertise the Indian IT sector both domestically and abroad.

NASSCOM offers a forum for cooperation among a range of stakeholders, including IT firms, governmental agencies, academic institutions, and international organizations. Its main goals include promoting the interests of the sector, enabling networking and knowledge-sharing among member organizations, and assisting in IT skill development and talent augmentation.

Table.1.clearly shows the difference in salaries payable for various Manufacturing Industries (Core Industries) and Software industries' employees. In recent days, core branch employees have faced many difficulties due to this difference in payment for their work. To Overcome this position for core employees, the government has to take initiatives to promote core engineering branches like EEE and Mechanical:

- The government can encourage the expansion of key engineering industries by offering financial incentives to businesses that establish or extend their operations in these sectors. For graduates in core engineering, additional jobs will result from this.

- Establishing baseline standards for the caliber of instruction and facilities will allow the government to control the expansion of private engineering colleges. This will ensure that graduates from these colleges have the abilities and information needed to be successful in the employment market.

- Raising public knowledge about the career prospects in core engineering branches: The government can do this by organizing outreach initiatives and disseminating information that highlights the opportunities present in these industries. This will encourage more students to enroll in core engineering courses.

- Increasing industry-academia cooperation: The government can increase industry-academia cooperation through sponsoring collaborative research initiatives and internships. This will make it easier to make sure that engineering education meets industrial needs.

- Creating training and skill-development programs for graduates of core engineering programs: The government can create training and skill-development programs for graduates of core engineering to assist them in acquiring the skills necessary to succeed in the employment market. Governmentalorganizations, business groupings, or commercial training companies may all offer these programs.

Table 1 :
Salary Statistics As Per Nasscom 2023 in Various Fields

S.No.	Reference Report	Average Salaries in India
1	NASSCOM. "The Indian IT-BPM Industry in Numbers."2023	In India, a software engineer makes an average yearly payof **INR 6 lakh**. An Indian core manufacturing engineermakes an average yearly income of **INR 4 lakh**.
2	Pay-scale. "Salariesin the Software Industry." 2023	In India, a software engineer makes an average yearly payof **INR 6.5 lakh**. In India, a core manufacturing engineer makes an average yearly pay of **INR 4.5 lakh.**.
3	Linked-in. "Salaries in the Manufacturing Industry." 2023.	In India, a software engineer makes an average yearly payof **INR 7 lakh**. An Indian core manufacturing engineermakes an average yearly income of **INR 5 lakh**.

Placement Analysis At Hitam

The above figures 2,3&4 represent a comparison of salaries payable for core branches and Computer science Engineering Departments at HITAM for the 2022 and 2023 academic years. The highest package by CSE is 9.9 LPA in MAERSK Company. Core branches are getting fewer packages in software industries whereas Core industries are recruiting fewer people with very basic packages due to a lack of communication skills, Coding skills, and industry interaction.

So, to overcome this situation, in HITAM, the Student Skill Development Centre (SSDC) was established to build interaction with core industries by giving training as per their current industry

requirements, and the Career Development Center (CDC) was also established to give training on Coding, Communication skills and will provide the placements.

Fig. 2 : Annual Average Salary Payable in 2022 for Various departments

Fig. 3 : Annual Average Salary Payable in 2023 for Various departments

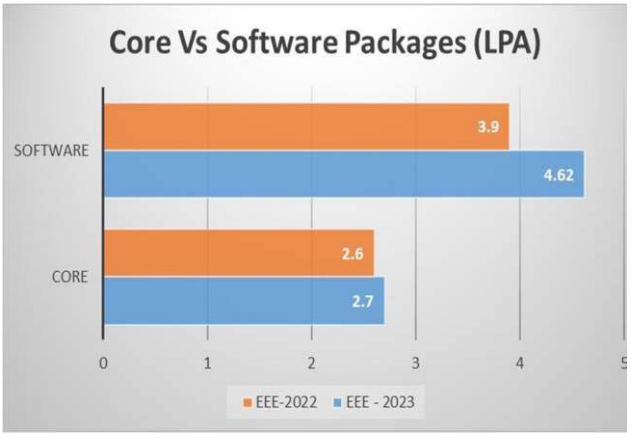

Fig. 4 : Analysis of Salary Payable for Core and Software Jobs

In addition to the SSDC and CDC, respective departments will provide Subject experts to deliver lectures from various industries, and Industrial visits will provide exposure in the real-time market, also by integrating different types of pedagogic and Project-based learning into their academics, students' involvement will enhance various activities which leads to good placement.

With this, all students will get equal packages irrespective of the branches and with the support of the government and all industries.

Conclusion

The crisis that core engineering branches are currently experiencing is a complex problem that is driven by a number of factors, including admissions, placements, government assistance, and the link between industry and academia. As students increasingly choose alternate professions, the need for seats in basic engineering disciplines has decreased. As a result, there is a scarcity of trained workers in significant industries. Government programs to close the gap and advance these disciplines are encouraging, although it is unclear how effective they will be. Graduates are ill-prepared for the demands of the labor market as a result of the gap between academic requirements and those of industry. A comprehensive strategy comprising coordinated efforts from politicians, industry players, and educational institutions is required to solve these issues. The crisis in basic engineering branches can be gradually alleviated by matching curriculum to industry requirements, providing desirable placement possibilities, and securing ongoing government backing. Without prompt action, the viability of crucial industries depending on these disciplines may be in danger, highlighting the need for finding a holistic solution to this problem.

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