iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** IV **Month of publication:** April 2021

DOI: https://doi.org/10.22214/ijraset.2021.33822

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue IV Apr 2021- Available at www.ijraset.com

Developing a Socially Responsible Engineer: Manifestation of Education, Law and Code of Ethics

Pragati Patel
Department of Law, Rajeev Gandhi College

Abstract: ***Global society is facing formidable current and problems that threatens the prospects for justice, peace, sustainability, and the well-being of humanity both now and in the future. Most of these problems are related to science and technology. The engineering profession has a variety of ethical responsibilities towards society and environment. It varies across different nations, cultures, engineering disciplines and by gender. The common factors include human safety and environment protection in engineering designs. The present work explores and finds that, the practices of technical education, professional code of ethics, and legislation when together will help in developing a socially responsible engineer.***
Keywords: Social responsibility, ethics, law, engineering ethics

I. INTRODUCTION

Engineering is a scientific field that involves using one's scientific understanding of the natural world and using it to invent, design and build solutions of problems and achieve practical goals. Social responsibility of engineers' is perceived to be a part of their professionalism. Here, the profession of engineers is no different from others towards society. However, there exists a diversity of opinions within the engineering profession about what specifically these social responsibilities entail. There are differences among sub-disciplines within engineering and across different countries and cultures. [1]

A. Social Responsibilities of an Engineer: A necessity?

Responsibility is a very general and too formal concept that presupposes a unit behind which several different meaning and partial interpretation hide. "Responsibility means to be willing or to be able to respond to something (action, decision, task, etc.) and to somebody for some authority." [2] The human being is being capable of assuming responsibility. The engineering profession has a variety of ethical responsibilities to society and the environment.

Causal responsibility implies the consequences of our action. Where a person is responsible for the results of his inaction or action. Prevention is a connected responsibility, frequently deployed in engineering sector. While the responsibility based on the capacity derives from our aptitude to do something that is to say if someone is qualified to understand, to plan, to act, to judge and if s/he possesses the knowledge and capacity of accomplishment as well as the demanded qualification. A moral theory defines terms in uniform ways and links idea and problems together in consistent ways.

This is exactly how the scientific theories are used in other engineering classes, scientific theories also organize ideas define terms and facilitate problem solving.

1) *A Classic Case:* There is a captain of a big steam vessel 'A'. While on a voyage, without any fault or negligence on his part, he suddenly found his vessel approaching a huge iceberg. He discovers that he himself can avert the situation if he can stops his vessel. However, he must inevitably run down a boat 'B' with twenty passengers onboard. Interestingly, he has a third option to run down other boat C with only two passengers onboard. Here if A alters his course without any intention to run down the boat C and in good faith for avoiding the danger for the passengers in the boat B, he is not guilty of an offence. Although on his running down the boat C for saving both A and B is likely to cause death of two passengers, it is a matter of fact that the danger which he intended to avoid was such as to excuse him for the result of his action. An engineer while working faces similar ethical dilemma.

II. SOCIALLY IRRESPONSIBLE ENGINEER: CASES

An innovation in biotechnology has enabled scientists to develop genetically modified food to cater human requirements. However, all Genetically Modified Food products are banned for commercial cultivation in India except Bt. cotton. It is an only approved Genetically Modified (GM) crop here. [3] This is because; computerised simulation models have limitations and cannot replicate real life situations to a very high degree of accuracy, especially when human life is risked. As, long-term impacts of such GMOs developed by biotech-engineers is still unknown. In this situation, we see that law came to rescue the engineers from socio-ethical dilemma.

©IJRASET: All Rights are Reserved

One of the most disastrous industrial accident, the infamous Bhopal Gas leak tragedy showed the extent of damages in terms of human life, and property an engineering fault could cause. The technical malfunction because of technician's error or improper maintenance caused mixing of water with chemicals and eventual release of *Methyl Isocyanate* gas. An estimated 350000 people were exposed resulting in more than 10000 deaths. [4]

Civil engineering infrastructure that can resist in the event of floods, earthquakes, or cyclones are considered safe. While the infamous *Veligonda* railway bridge collapse could not vet the same. This accident occurred when a large irrigation tank ruptured, spilling around thousands cusecs of water. As, a result, of this flash flooding the bridge collapsed, causing major loss of human life. On investigation, it was found that the bridge's piers were not designed for floods. [5]

Indian power infrastructure has witnessed the two most rampant blackouts due to grid failure in the year 2001 and 2012. In the year 2001, a section of the Northern power grid collapsed leading to cascading effect on complete north grid. The reporting and control equipment at many places were out of order or under maintenance.[6] While in the year 2012, failure of defense mechanism, skewed load generation balance across regional grids, non-performance of the protection systems were the major causes. [7] Technical lacunae in a critical sector such as power, indicates the predicament about lack of awareness and concern for social responsibility among technical personnel.

A global automobile manufacturer was discovered tampering its software design to circumvent emissions standards of the USA's Environmental Protection Agency. The EPA found that Volkswagen's software in its car manipulated the amount of emissions occurred during testing of the levels of emission. This illicit practice costed huge impact on finances and reputation of such a trusted brand. [8] [9]

There are also questions about public accountability of business using computer-based services. The personal and financial details of consumers are taken by the companies and maintained as records in their servers. Most of these servers are physically located outside India. They inter alia pose a serious threat to individual's privacy, and national security. It should be made sure that these companies do not use details of computers unethically. Stock trading is the automatic, hands off, computer trading of the stocks, future and options on the stock market. There is dearth of assurance existing with respect to the power controllers in the organisations who have control over algorithms that are developed to run these softwares do not exercise power to manipulate markets and control the prospective selling and purchases processes keeping their interests in mind. The market regulator SEBI fined a hefty amount of ₹ 1190 Cr. on accused for providing unfair access through co-location servers placed at the site of exchange, which could speed up algorithmic trading.[10] With the rise of data generation, a new era of artificial intelligence (AI) and big data has emerged. Big Data has intensified surveillance trends associated with information technology and networks. This implies in name of big data analytics both corporations and governments are violating the privacy of IT users. The engineers engaged by such organisations have shifted their focus from earlier legit revenue generation through anonymous data analysis to intense severs surveillance. [11]

They justify unprecedented access to data looking for historical trends in quest for pattern-discovery to provide a more personalized experience. Users need to diligently read and then provide access to their personal data in smart phones, computers and other gadgets. Right to privacy is a fundamental right under article 21 of the Indian Constitution [12]. Social responsibility of a modern computer engineer encompasses the questions of privacy. In the absence of strong laws like GDPR [13], an engineer in India has a pivotal role to play in securing the privacy rights of fellow humans.

A. Page Layout

Your paper must use a page size corresponding to A4 which is 210mm (8.27") wide and 297mm (11.69") long. The margins must be set as follows:

1) Top = Bottom= 19mm (0.75")
2) Left = Right = 14.32mm (0.56")

III.CODE OF ETHICS

A code of ethics is a manual that guides a professional engineer towards ethical ways of executing the task assigned. The NSPE code of ethics asks engineers to hold paramount the safety, health, welfare of the public, and to avoid deceptive acts. Engineers uphold and advance the integrity, honour and dignity of the engineering profession. [14] The CSI's code instructs the engineers to make the most effective use of all natural resources employed, be prepared to offer professional assistance in community affairs, and use a computer considering the respect for fellow humans. [15]

©IJRASET: All Rights are Reserved

While the code for IEI, indicates its member's highest regard for equality of opportunity, social justice and fairness. It also entrusts a member engineer to act for maintenance of sustainability in the process of development. [16] The notion of remaining protected from risks of physical, psychological injuries or death, can be called as safety.

The Ministry of Human Resource Development has constituted an expert committee to draft a bill for a professional council of engineers. In this, code of ethics is being proposed for engineers with a penalizing clause, which would mean, if an engineer does not follow ethics and code then, their license for professional practice may be cancelled. [17]

IV. DISCUSSION

It is said that necessity is the mother of invention. When sense of responsibility lacks or creates inaction then law comes to rescue. The legal responsibility derives from the legislation in force in a certain time-space. It is limited in scope, divisible and is punishable. Nevertheless, there can be areas where lack of responsibility causes a problem then, legislation provides an instant and effective solution to an engineers' dilemma.

The traditional ideal of the universities is to foster creative and independent thought with a spirit of inquiry. They challenge perceived beliefs, explore new horizons and are intended to forget external constraints. It is an ideal that has no doubt been flawed in practice, but to the extent that it is realized, is a good measure of the level of civilization achieved so far. There is no way to measure the human and social costs of converting schools and universities into facilities that produce commodities for the job market, abandoning their traditional ideals. As a client and as a society, we want; engineers to design solutions keeping in mind its social acceptance and ethical paradigm. That being an expectation, does the engineering curriculum trains a person to be socially responsible?

The answer in India's respect is NO! The model AICTE curriculum includes a single subject that too only in civil engineering domain. Does that implies engineers in all other domains are not to be socially responsible or ethically right? Without conditioning and training, the engineering students cannot develop themselves as a socially responsible engineer. Other professionals, such as MBBS doctors or lawyers are trained and attuned to think, behave and perform in an ethical framework, while their education in colleges.[17] [18]

Although professional organisations have expressed the need for the provisions of teaching about social responsibility to technical students. [5, 16, 19] Persistent barriers stand in the way of its continuous development. Nevertheless, they do it for their specific field of engineering called as "Professional Code of ethics". There is a need of bottom-up teaching initiatives from individuals, groups of academic teachers and top down support from policy makers to secure appropriate embedding in the university. Often the latter is lacking or inadequate.

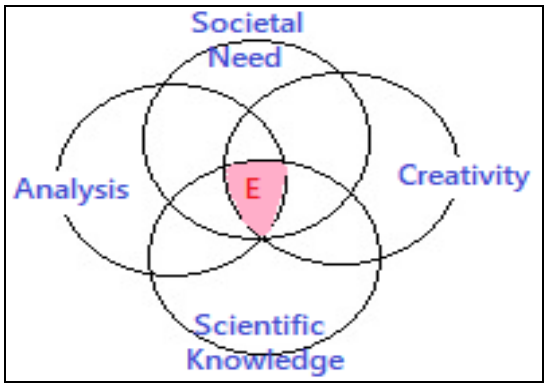


Fig. 1 Socially responsible engineer

In the Fig.1, marking *E* illustrates the intersection set that makes a socially responsible engineer. Being one of such encompasses a culmination of scientific knowledge, analysis and creativity.

In a recent study, engineering students, showed a significant difference in their self-perceptions of increased social responsibilities. The study was carried out over a period. It was done to find the impact due to change in curriculum *inter-alia* social responsibility. The survey notes that a decline in learning attitudes toward the program may be incident during the curriculum transition. Education policies at the national or international level such as the *Swachh Bharat Abhiyan*, *Unnat Bharat Abhiyan* can be an opportunity for initiating a sense of social responsibility among budding engineers. Such programs must enable higher educational institutions to work with common people of India to identify development challenges and provide solutions for accelerating sustainable growth.

©IJRASET: All Rights are Reserved

If the social responsibility of an engineer implies a duty to safeguard or promote a peaceful society then science and engineering should empower students to fulfill this role. The present system of technical education is insufficient in preparing future engineers for their socially responsible role.

Engineers being at the bottom of the corporate pyramid have to act in accordance to their bosses that mostly are profit driven corporates. Moreover, existing accreditation and evaluation mechanisms do not guarantee appropriate attention to teaching for social responsibility because in their current form they provide no guarantee that the curricula pays sufficient attention to teaching goals that are desirable for society as a whole.[19] Fig.2 illustrates the interrelation between applied engineering and ethics.

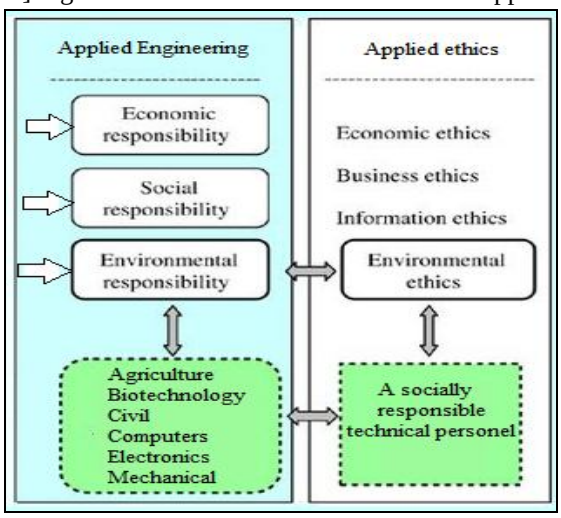


Fig. 2 Balancing ethics and responsibilities

The trust of public in engineering requires that the professional consider the impacts of their action on human safety. There is widespread consensus in the codes of ethics of engineering professional societies worldwide that engineering has a primary duty to protect public safety, health, and welfare. [20]

V. CONCLUSIONS

People care what technology *can do* for them while ignoring what it can do *to* them. Technology is mediated, both acting on and acted upon by society. It is so powerful that philosophical thought about its development and societal implication is to be considered before its application. The responsibility of being accountable for the effects of technology on our lives and the ways in which technology must involve values and social agendas. The responsibility of an engineer towards society include increase in their outreach to help others achieve their true potential. Although the paradigm of social responsibility can be taught and trained in our technical institutions, it will depend largely on a professional engineer deputed at a project site to take a call on to be an Edward Snowden or not.

Hence, for engineers, corporations, and society as a whole needs to deliberate on how technology can be developed and used to promote the greater benefit for common good. A proactive approach is needed, to address issues about environment, developing a sense of dignity and collective destiny.

VI. ACKNOWLEDGMENT

I would like to acknowledge the support of my *alma-mater*, Dr. H.S. Gour Central University Sagar, mentor and colleagues at the present institute Rajeev Gandhi College, Barkatullah University, Bhopal, for all their support.

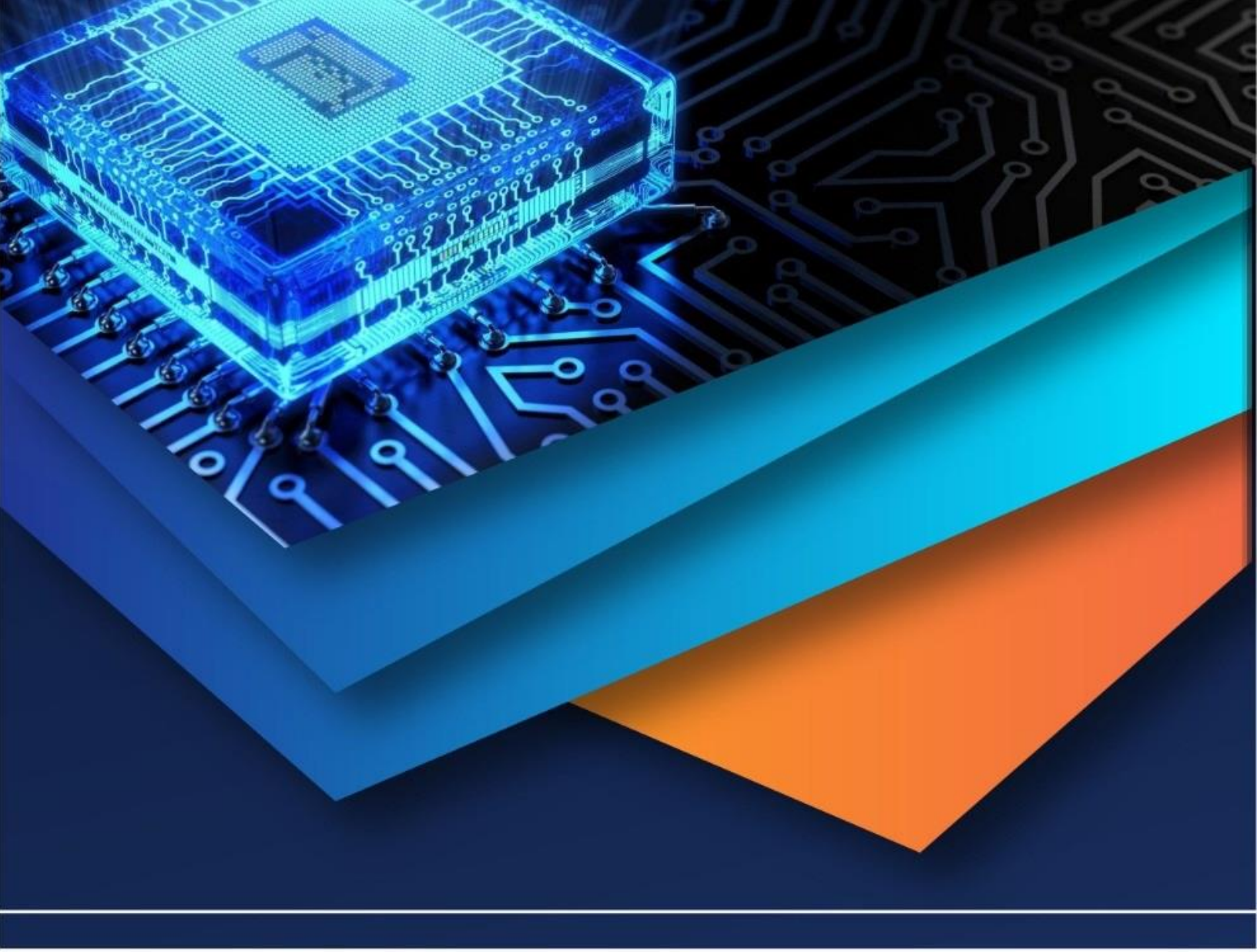
REFERENCES

[1] Unger, S. H., “Controlling Technology: Ethics and the Responsible Engineer”, Place: Columbia University. 1987
[2] Lenk, H., Einführung in die angewandte Ethik, Berlin, Kohlhammer. 1997.
[3] BAN on GM CROPS, PIB, Ministry of Agriculture & Farmers Welfare, Govt of India, 02-July-2019, accessed on 02 Sep, 2019, via https://pib.gov.in/newsite/PrintRelease.aspx?relid=191120
[4] Paul Cullinan- “Case study of the Bhopal incident” Environmental toxicology and human Health – Vol. I - Encyclopedia of Life Support Systems (EOLSS)
[5] https://cse.gndec.ac.in/csi/?q=node/3 Accessed on 01 Sep 2019
[6] Grid disturbance & restoration orders – Central Electricity Regulatory, accessed on 02 Sep 2019 via www.cercind.gov.in/180101/Disturbance.pdf
[7] Report on Grid Disturbance On 30th & 31st July 2012. www.cercind.gov.in/2012/orders/Final_Report_Grid_Disturbance.pdf

©IJRASET: All Rights are Reserved

[8] Dr. Frank J. Cavico, "Volkswagen Emissions Scandal: A Global Case Study of Legal, Ethical, and Practical Consequences and Recommendations for Sustainable Management", in Global Journal of Research in Business & Management Vol. 4, No. 2, April 13, 2016 www.gpcpublishing.com ISSN: 2454-3128
[9] Stanwick, Peter, and Sarah Stanwick. "Volkswagen emissions scandal: The perils of installing illegal software." International Review of Management and Business Research 6.1 (2017)
[10] Securities and Exchange Board of India- "Adjudication order in the matter of NSE Col-Dark Fibre," https://bit.ly/35aN4xE
[11] Syverson, Paul & Goldschlag, David & Reed, Michael. (1997). Anonymous Connections and Onion Routing.. Proceedings of the IEEE Computer Society Symposium on Research in Security and Privacy. 44-54. 10.1109/SECPRI.1997.601314.
[12] Lyon, David. "Surveillance, Snowden, and big data: Capacities, consequences, critique." Big Data & Society 1.2 (2014): 2053951714541861.
[13] Justice KS Puttaswamy (Retd.) and Anr. Vs Union of India and Ors., Writ petition (Civil) no. 494 of 2012, decided 24 Aug, 2017
[14] Purdue Engineering, "NSPC Code of ethics", accessed via, https://engineering.purdue.edu/MSE/academics/undergraduate/ethics.pdf
[15] Sandra A., A Lathem, Maureen D., Neumann, and Nancy Hayden, "The Socially Responsible Engineer: Assessing Student Attitudes of Roles and Responsibilities", University of Vermont Journal of Engineering Education July 2011, Vol. 100, No. 3, pp. 444–474 © 2011 ASEE. http://www.jee.org
[16] IEI Code of Ethics, http://ieigsc.org/code-of-ethics, Accessed on 30 Aug 2019
[17] *New Bill wants engineers to register, follow ethics code*, The Hindu, R. Sujatha Chennai, September 15, 2019 http//thehindu.com/news/national/new-bill-wants-engineers-to-register-follow-ethics-code/article29420596.ece
[18] Rules of Legal Education, 2008- Bar Council of India, http://www.barcouncilofindia.org/wp-content/uploads/2010/05/BCIRulesPartIV.pdf
[19] Recommendations from Engineers' Conclave, accessed via https://www.inae.in/storage/2018/12/Recommendations-2016.pdf
[20] AERB Code of ethics, https://aerb.gov.in/english/about-us/code-of-ethics
[21] Competency based under graduate curriculum for MBBS- MCI, https://www.mciindia.org/CMS/information-desk/for-colleges/ug-curriculum
[22] Engineering Accreditation Committee, Criteria for Evaluating Engineering Programs, ABET Inc., 2013.
[23] Rodrigo *et. al*, "Social Responsibility in Engineering Based Commercial Organizations", in International Conference on Interactive Collaborative Learning (ICL), 2015, 978-1-4799-8707-8/15

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)