Open Peer Review on Qeios

Planning Courses on Ethics in Engineering Curricula

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Abstract

Ethics in engineering practice is about the professional responsibilities of engineers which have been recognized as an important foundation in the practice of engineering throughout the world. Ethical decision-making is essential to professionalism in engineering. Further, ethics is a required topic in an accredited engineering curriculum. In this paper, the need for ethics, the process of incorporating it into an engineering curriculum, and implementing it is presented based on the feedback from 76 senior faculty members from the southern region of India through case studies, and analysis. Based on this study additional courses, seminars, short-term finishing school modules, mass open online courses (MOOCs) on ethics, training the faculty members, and developing administrators to follow standard practices in recruiting, and promoting them are suggested. The trained faculty members would introduce ethical codes which will prevent engineering failures and safeguard human life and ensure public health.

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1. Introduction

Engineering is the process of developing an efficient mechanism that quickens and eases the work using limited resources with help of technology. Ethics are the principles accepted by society, which also equate to the moral standards of human beings. Every engineer with ethics should help society in a better way (Tutorial point.com). Some of the moral codes are being good to citizens, communicating only the truth, going against wrong principles, having chastity, and never

cheating. Engineers are vital to shaping our world. Their decisions have far-reaching consequence-typically related to risk management. Engineering ethics are principles and guidelines engineers follow to ensure their decision-making is aligned with their obligations to the public, their clients, and their industry. As such, engineers need to hold themselves to a high professional standard. Ethical issues that exist in engineering have to be improved (Esther Han, 2023). Ethics in engineering should promote safety, enhance quality, improve public opinion, safeguard the company's and department's interests, foster sustainability, protect engineers, and secure the company's/department's assets. Ethics is the study of what is right or wrong in human conduct. Ethics can be stated as moral philosophy. Hence, Ethics = (Morals+ Reasoning). Ethics is all about reasoning about how an engineer should act in a given circumstance- i. e. how to do the right action. Determinants are the sources from which the ethical standard arises. Some of the determinants of ethics are law, government, society, client, knowledge, and time. A consequence is the outcome of any act. Doing good with proper reasoning (being ethical) has many positive consequences like safeguarding society, creating credibility, satisfying basic human needs, feeling good, etc. However, being unethical has many negative consequences the loss of trust, nepotism, corruption, crimes, etc. Ethics is based on well-founded standards of right and wrong that prescribe what engineers ought to do, usually in terms of rights, obligations, benefits to society, fairness, or specific virtues (Manuel Velasquez, et al.). Ethics refers to well-founded standards of right and wrong that prescribe what engineers ought to do in terms of rights, obligations, benefits to society, fairness, or specific virtues. Further, ethics refers to the study and development of the engineer's ethical standards. It is necessary to constantly evaluate engineering standards to ensure that they are well-founded and follows established Indian and global standards.

1.1. Current Scenario

Most Indian universities have not included ethics as a separate course even though the Accreditation Board of Engineering and Technology (ABET) or National Board Accreditation (NBA) or National Assessment and Accreditation Council (NAAC) initiated a requirement for all engineering programs to address ethical issues. Engineering curricula without considering ethical standards lead to many failures and disasters. Hence, there is a need to integrate ethics content into the engineering curricula itself. Integration facilitates students to see ethics as a core component of engineering and might lend the engineering course greater credibility in the eyes of the recruiter. An ethical engineering graduate will alone follow the law which will safeguard society from disasters, increase trust, eliminate corruption, and eradicate crimes and nepotism. He/she will safeguard society.

1.2. Desired Scenario

Engineering students have to be taught the need of following ethics in planning, design, construction, testing, and maintenance of buildings, equipment, machines, roads, bridges, transport systems, power systems, environmental protection, elimination of pollution, etc. Also, the administrators of engineering institutions have to be developed to follow ethics in recruiting faculty members, planning, developing, and governing the engineering institutions. The commitment to excellence will produce an impact on the Gross Domestic Product (GDP).

2. Literature Survey

21st Century advances in engineering and technology demand engineering and technology graduates who have to handle human, social, and complex problems. The fast advancement in science, mathematics, and technology demands an awareness construction and a standard-setting for ethical behavior and conduct in society that can be achieved by engineering education. Engineering students must have the ability to analyze, design, develop innovative prototypes, test, improve, manufacture, and maintain the products. They have to find solutions to different and complex ethical problems and dilemmas that must be developed and continuously improved. The vision of engineering colleges and universities demands that engineering graduates contribute to human capital by reshaping the social, economic, and legal contexts. Therefore, the engineering profession is not only concerned about the application of knowledge capital but also about the utilization of knowledge capital in an ethical manner. Ethics in engineering which have been recognized as an important foundation in the practice of engineering practice is about the professional responsibilities of engineers (Yehia, 2008). Codes of ethics concern honesty and truthfulness responsibility (BohatALA). If the engineers are experts, they can earn the public trust. The safety of people is their concern. All the engineering codes have the set forth statement of engineers' responsibility.

Engineering ethics has to be taught to engineering students as a practical course that deals with real-life contexts. Hence, professional responsibilities have to be introduced through these ethics to prepare the students for real-life ethical challenges. Ermer and Vandert define engineering ethics as the study of moral problems confronted by engineering graduates and organizations. Li and Fu stated that ethics consist of the responsibilities and rights of those engaged in engineering, and also their desirable ideals and personal commitments. According to them, ethics is the study of the policies, values, and decisions that are morally desirable in engineering research and practice. In the last twenty years, many universities have established separate Centers on Ethics [example: Markkula Center for Applied Ethics at Santa Clara University, USA]. Nassereldeen and Fatima have focused on environmental ethics as a discipline that studies the moral relationship of human beings to, and also the value and moral status of, the environment and its nonhuman contents. Tom Ricci (2012) has suggested various approaches to teaching engineering ethics like stand-alone courses in ethics, discussions of professional responsibility and ethics, modules, and case studies on engineering ethics. Charles Edwin Harris, Jr. et al. (1996) have suggested case studies that an engineer is more likely to encounter ethics. Shirley Fleischmann (2004) emphasized the need for introducing ethics into the engineering curriculum. Canan Ozgen (2015) has suggested including ethics education in an undergraduate engineering curriculum. Anne Colby and William Sullivan (2008) have suggested offering stand-alone courses in ethics within engineering colleges, discussions of professional safety, and modules on engineering ethics. They further suggested capstone design courses. Susmita Mukhopadhyay of the Indian Institute of Technology (IIT) Kharagpur developed a mass online open course (MOOC) on "Ethics in Engineering Practice". Reena Cheruvalath (2015) of Birla Institute of Technology (BITS) Pilani explored the issues and challenges in teaching ethics to engineering students in India. Further, she concluded to close the gap in teaching ethics to the students. University of Patras, Greece has suggested introducing ethical theories through role-playing workshops for undergraduate engineering students. Charles has suggested developing case studies in engineering ethics. Rishi Gupta of the University of Victoria, Canada offered a value-added course on "Improving Safety, Ethics, and Professional

Practice in Engineering via Youth Training at the Institute of Technology of Nirma University. Anna University-Chennai has introduced a course on “Professional Ethics in Engineering” for the students of Bachelor of Engineering (B.E) of this university. The objectives of this course are to enable the students to create awareness of engineering ethics and human values, to instill more values, and loyalty, and appreciate the rights of others. This course consisted of the following five units: 1. Human Values, 2. Engineering Ethics, 3. Engineering and Social Experimentation, 4. Safety, Responsibilities, and Rights, and 5. Global Issues. All India Council for Technical Education (AICTE) has taken the initiative by adding a course on “Professional Ethics” to the engineering curriculum. Synthesis of recommendation on introducing ethics to engineering students: Table 1 presents the significant suggestions

Table 1. Synthesis of recommendations of various researchers

S. No.	Suggested Teaching Method	Researchers
1.	Adding Ethics into an engineering curriculum Repositioning Ethics at the Heart of engineering graduate	Alison Joy Gwynne, et al. (2021)
2.	Ethics Education in undergraduate engineering curricula Ethics in Teaching in Undergraduate Engineering Education	Canan Ozgen. (2015) Anne Colby and William Sullivan. (2008)
3.	Freestanding courses in Ethics, Modules, Ethics, and mini-courses	Michael Davis and Kathryn Riley (2008)
4.	Methods of Incorporating and understanding professional ethics	Anna University, IIT Kharagpur, Nirma University, Yehia Khulief (2008), Reena Cheruvalath (2015), AICTEE.
5.	Engineering Ethics: What? Why? How? And when?	Charles Edwin Jr. et al. (1996)
6.	AI-Two Frameworks for Ethical Design Practice	Dorian Peters et al. (2020)

2.1. Inference

Three major methods of incorporating ethics in engineering curricula are 1. Standalone Course, 2. Modules, 3. Case Studies. Most universities have introduced courses on ethics in the last 20 years based on the accreditation requirements. There is no single method of planning an ethics course. In due course, a standard method would arise to safeguard the graduates from many disasters due to not having expertise in professional ethics.

2.2. Code of Ethics for Engineers Recommended by Various Organizations

Most professional organizations have developed codes of ethics for engineers. Some of the codes are presented in this section.

2.2.1. IEEE Code of Ethics

The members of IEEE accept their obligation to their profession, its members, and the communities they serve, do hereby commit themselves to the highest ethical and professional conduct, and agree to uphold the highest standards of integrity, responsible behavior, and ethical conduct in professional activities.

2.2.2. National Society of Professional Engineers (NSPE)

According to NSPE, engineering is an important and learned profession. Engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and total impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest practices of ethical conduct. Further, NSPE described fundamental canons, rules of practice, and professional obligations.

Under Rules of Practice, the following are emphasized by NSPE:

1. Engineers shall hold paramount the safety, health, and welfare of the public.
2. Engineers shall perform services only in the areas of their competence.
3. Engineers shall issue statements only objectively and truthful mannerly
4. Engineers shall act for the employer or client as faithful agents or trustees.
5. Engineers shall avoid deceptive acts.

Under Professional Obligations, the following are emphasized by NSPE:

1. Engineers shall be guided in all their relations by the highest standards of honesty and integrity.
2. Engineers shall at all times serve the public interest.
3. Engineers shall avoid all conduct or practice that deceives the public.
4. Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve.
5. Engineers shall not be influenced in their professional duties by conflicting interests.
6. Engineers shall not attempt to obtain employment or advancement or professional engagements by untruthfully criticizing other engineers, or by other improper or questionable methods.
7. Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputations, prospects, practice, or employment of other engineers. Engineers who believe others guilty of unethical or illegal practice shall present such information to the proper authority for action.
8. Engineers shall accept personal responsibility for their professional activities, provided, however, that engineers may seek indemnification for service arising out of their practice for other than gross negligence, where the engineer's interests cannot otherwise be protected.
9. Engineers shall give credit for engineering work to those to whom credit is due and will recognize the propriety

interests of others.

All of the above are apply to Indian engineers and they need to be incorporated into the ethical standards, case studies, and field practices.

2.2.3. Royal Academy of Engineering and Engineering Council

In 2005 the Royal Academy of Engineering and the Engineering Council jointly created a statement of ethical principles to guide engineering practice and behavior. According to them, the Statement of Ethical Principles is underpinned by four fundamental principles: 1. Honesty and integrity, 2. Respect for life, law, the environment, and public good, 3. Accuracy and rigor, 4. Leadership and communication. They have provided 12 case studies for teaching ethics at the undergraduate level.

2.2.4. New Mexico University Course on Engineering Ethics for Professional Engineers

This online engineering course presents the laws and rules of professional responsibility governing the practice of engineering in the State of New Mexico, USA. This course applies to Professional Engineers licensed in the State of New Mexico who are required to demonstrate continuing professional competency in engineering ethics as a condition of their license renewal.

2.2.5. American Society of Civil Engineers (ASCE)

According to ASCE, engineers govern their professional careers on the following fundamental principles: i) Create safe, resilient, and sustainable infrastructure; ii) Treat all persons with respect, dignity, and fairness in a manner that fosters equitable participation without regard to personal identity; iii) Consider the current and anticipated needs of society; and iv) Utilize their knowledge and skills to enhance the quantity of the life for humanity. Under the code of ethics, they described ethics under society, natural and built environment, profession, clients and employers, and peers.

2.2.6. Institution of Engineers (India)

The Institution of Engineers (India) has prepared a Code of Ethics for Corporate Members. The corporate members should be committed to promoting and practicing the profession of engineering for the common good of the community in mind the following concerns: Concern for ethical standards; Concern for social justice, social order, and human rights; Concern for the protection of the environment; Concern for sustainable development; and public safety and tranquility. Further, they stated the tenets of the code of ethics and general guidance.

2.2.7. Faculty Handbooks on Ethics

Indian Institute of Technology (IIT), Bombay, and Tamil Nadu Agricultural University (TNAU), Coimbatore have brought a comprehensive handbook by incorporating the ethics, responsibilities, benefits, administrative rules, etc. Such faculty handbooks could be developed by all engineering institutions.

All the above professional organizations have thoroughly examined every aspect of ethics in engineering. Further, they have given in-depth guidelines for implementation and getting the required Professional License. These ethics codes can be incorporated into Indian Engineering Education. Case studies can be developed for the students. Indian engineers need professional licenses and efforts are to be made they have in-depth expertise in ethics.

3. Research Objectives

The following are the research objectives:

1. To assess the overall knowledge of the engineering faculty members on the ethical standards that they have to follow in designing curricula and implementing various courses for engineering students.
2. To develop suitable methods of introducing ethics in curricula of various engineering programs and implementing them as per the best ethical standards.
3. To suggest ethical methods of faculty recruiting, pre-service training, faculty orientation, assessment of the performance, declaring probation completion, and scaffolding the performance in teaching, research and consultancy works, leadership development, promotion, and contribution to the diverse global programs.

4. Research Methodology

The research methodology is based on open the social science model, collecting information from the participants (faculty members and students). Analyze the feedback and comparing with the standards of law, rules, and natural justice. Preparing suitable models on including ethics in engineering curricula and validating them through a set of experienced senior engineers and engineering educators.

4.1. Research Questions

The following research questions have been prepared to check the knowledge of the faculty members, current practices, and further activities to include ethics in various courses.

1. What is needed for introducing ethics in engineering courses?
2. How will you integrate ethics into engineering programs?
3. Whether your institute/university offers any course on ethics?
4. Whether the faculty have been trained to develop any course on ethics?
5. Whether your institute follows the recruitment rules for directly selecting an engineering faculty as per the AICTE?
6. Whether your institute follows the promotional rules to upgrade the faculty periodically as per the AICTE norms?
7. Whether the engineering departments of your college have prepared any case studies on the problems faced by engineering graduates?
8. Whether your college offers any finishing course on ethics to engineering students?

9. Whether your college conducts any seminars on ethics for the students?
10. Whether your department conducted any tracer study on the problems faced by the alumni on ethics?

4.2. Population

Middle-level faculty members (senior assistant professors, associate professors, and professors) of various engineering programs who have at least 15 years of experience, possess minimum master's degrees and work in affiliated engineering colleges, autonomous colleges, deemed universities, and state technical universities in the southern region of India.

4.3. Sample

76 faculty members were purposely selected. 17 female faculty members and 59 male faculty members in various engineering branches have participated in this research program. 21 were from autonomous colleges, 32 were from government-aided colleges, 17 were from deemed universities and 16 were from state technical universities. Most of them have undergone short-term faculty development courses on curriculum design, instructional materials development, higher education administration, institutional evaluation, and change and development.

4.4. Feedback from the Participants

Ten questions were developed to get their view points. These questions were developed based on the needs for introducing ethics in all engineering institutions so that graduates will be prepared to implement various projects to provide needed services without any harm to the people, environment, and safety. Likert's four points were used to rate their feedbacks.

Table 2. Feedback from the Participants

No.	Issue	Always (4)	Frequently (3)	Sometimes (2)	Never (1)
1	Need for introducing ethics in engineering courses	82.89%	5.26%	9.21%	2.63%
2	Integration of Ethics into an engineering course	77.63%	9.21%	10.53%	2.63%
3	Offering a course on ethics to students	73.68%	10.53%	13.16%	2.63%
4	Training the faculty members on ethics	63.16%	13.16%	21.05%	2.63%
5	Following the AICTE recruitment rules for the faculty selection	13.16%	14.47%	28.95%	43.42%
6	Following the AICTE guidelines for promoting a faculty member	15.79%	7.89%	5.26%	71.05%
7	Preparation of case studies on ethics by the department	48.68%	15.79%	27.63%	7.89%
8	Offering a finishing school course on ethics to the students to complement other courses	5.26%	7.89%	5.26%	71.5%
9	Conducting in-house seminars on ethics for the students	14.47%	27.63%	1.32%	56.58%
10	Conducting Tracer Studies on the professional problems faced by the alumni	17.11%	5.26%	2.63%	75.00%

4.5. Synthesis of the Feedback from the Participants

Significant areas:

- Need for introducing ethics in the engineering curricula (82.89%)
- Integration of ethics in the engineering courses (77.63%)
- Offering courses in ethics to engineering students (73.68%)
- Training the faculty members on developing curricula and instructional materials (63.16%)

Areas that require attention

- Preparation of case studies on ethics (48.68%)

Weak areas:

- Tracer studies on the professional problems faced by alumni (17.11%)
- Conducting in-house seminars on ethics for the students (14.47%)
- Offering finishing school courses on ethics to students (5.26%)

Areas Concerning the Administration

- Following AICTE guidelines for promoting the faculty members (15.79%)
- Following AICTE rules for recruiting faculty members (13.16%)

4.6. Discussion

Due to the rapid development of the Indian economy, global placement of Indian Engineering graduates, frequent newspaper reporting on the failures of various projects, air pollution, water pollution, accidents, loss of life, urban growth, etc. made the faculty members accept the need for ethics in engineering. Many leading state universities and institutes of national importance have taken lead in offering courses on ethics to their engineering students. Now more branch-specific courses on ethics have to be developed in collaboration with industries, national laboratories, and expert faculty members. The courses have to be validated before being piloted. The administrators of engineering institutions have also to be developed in ethical recruitment, declaring probation completion, promoting the faculty members, in-house training, and scaffolding the faculty teams to undertake interdisciplinary research projects and consultancy works. There is a need for in-depth guidelines in these areas. IIT Bombay has produced a very comprehensive handbook for the faculty members which indicates the ethical process in all activities from recruitment and retirement.

5. Proposed Strategies to Develop and Offer Needed Courses in Ethics for Engineering Students

The following strategies have been prepared after in-depth discussions with the faculty members who participated in this research program. All these strategies could be developed in colleges and universities. There is a need for active partners to decide on desired outcomes and planned dissemination so that the suggestions can reach all the institutions. (Table-3)

Table 3. Strategies for developing courses, learning materials, and training the faculty members

No.	Strategy	Partners	Desired Outcome	Dissemination
1	Joint development of draft courses in ethics for every branch of engineering and validating them.	Representatives of industry and insurance companies, senior faculty members, lawyers, and alumni.	Branch and industry-specific courses. The roles of engineers at entry level and middle level of employment match the policies of the industry.	Through faculty development workshops, seminars, and distribution of draft courses for validation and implementation.
2	Preparation of case studies in ethics	Industry representatives, senior faculty members, and alumni.	Cases where failures occurred due to not following standards, rules, and ethics.	Do
3	Focus on the ultimate failures due to faulty design, testing, improvement, execution/ manufacturing, and maintenance.	Experts and authors of published case studies on failures, accidents, wrong components, pollution, high energy consumption, etc.	Collect the information on new composite materials, fire safety, deduction of smoke, built-in fire extinguishers, built-in warning system, etc.	Incorporate new design methods, new components, nondestructive testing methods, checking pollution, smoke deduction, auto controls, etc. Follow the national and international standards.
4	Preparation of educational video programs on ethics.	Institutes that have trained resource persons and educational video production facilities.	High-quality educational video programs on ethics.	Televising through educational television channels and selling the cassettes to engineering institutes.
5	Preparation of MOOCs through institutes that implement SWAYAM of the Ministry of Education of the Government of India.	Senior faculty members who are members of the Board of Studies of the Curriculum Development and Developers of MOOCs.	Planned MOOCs for faculty members and engineering students. 5000 trained faculty members per course of two months duration.	Through newsletters of the Indian Society for Training and Development (ISTE), All India Council for Technical Education (AICTE), Institute websites, and direct mailing to the institutes.
6	Finishing School Programs of one to two months duration.	Trained faculty members of engineering colleges.	Improved cognitive skills and attitudes to follow the ethics in planning, design, execution, and maintenance.	Through institute circulars. Fix an affordable course fee. Offer a certificate for completion.
7	Industrial visits where ethics are strictly followed.	Well performing companies in the state, region, and nation.	Achievement motivation to follow the best examples.	Planning educational tours and collaboration with CII, FIICI, and Associations of Micro, Small, and Medium Enterprises (MSMEs).
8	Seminars, Workshops, and Symposia on Ethics	International experts, industry leaders, reputed educational leaders, design engineers, etc.	Improved cognitive strategies, in-depth knowledge of ethics, and planning skills in instructional design and delivery.	Letters of invitation, circulars, websites, newspaper advertisements, and announcements in ISTE Newsletters.
9	Multi-Media Learning Programs in ethics (MMLP)	Institutions that have resources and trained faculty for multimedia learning package development.	Enhances self-directed learning, Problem-solving abilities, Attitude change, and Commitment to excellence.	Direct newsletter to engineering colleges, trained faculty can be given MMLP for conducting in-house training programs.
10	Offering research projects / postgraduate dissertation works in ethics	Companies face many hurdles in improving productivity, cost reduction, safety, and innovation.	Well-developed theses, research papers, intellectual properties, monographs, modules, etc.	Letters of Invitation (LOI), Bid documents, and sponsored research projects of various manufacturing associations.

5.1. Suggestions to Improve the Courses on Ethics

- During program accreditation, a check on the courses on ethics, method of implementation, and case studies used
- Providing grants-in-aid for developing course materials, case studies, and video programs in ethics

- Conduct faculty development programs under In-house Faculty Development Workshops
- Publishing modules, manuals, and case studies in ethics
- MOOC s on ethics for the newly recruited faculty members
- Grants-in-aid for the institutes which have implemented courses on ethics.
- Conducting tracer studies on alumni to get feedback on the quality of ethics courses and desired changes

5.2. Ethics in Professional Practice

The faculty members suggested collecting cases on the deviations of ethics in professional practices. Some of the sample cases are: Projects containing a material misrepresentation of facts, advertising for recruitment of engineers without following prescribed qualifications and experience, preparing articles for publication without following proper investigation, designing buildings without proper soil investigation, constructing buildings in low lying river beds/ unstable slopes, demanding bribes from the contractors, utilizing the laboratories for personal projects without paying the fees, using the workshop facilities for personal companies, advising the experts not to select the best candidates, reducing the scale of pay for the employees, transferring the engineers to remote places while implementing the sponsored projects, renting office building at very rents, transferring the consultancy projects to unknown companies, and increasing the cost of the projects- based on the unethical suggestions from a competitor. The students have to be guided to analyze the cases, and arrive at an alternate development process based on the facts, material qualities, standard design procedures, rules, and Acts. Students may be encouraged to present their findings in a class seminar.

5.3. Validation of the Suggestions

A team of 20 senior faculty members has been consulted to validate the suggestions. 75% agreed that they can implement the suggestions provided they plan the faculty development programs. 25% felt that they need a guide who can support the implementation of in-house implementation tasks.

6. Conclusions

Ethics is an important area in the engineering profession. Over the last thirty years, ethical standards have come solely to protect society from various manmade disasters. The need for introducing ethics in various universities is growing fast. The National Board of Accreditation (NBA) can accredit those programs which have introduced ethics. Considering the fast-growing demands from society, industry, and AICTE, comprehensive research has been undertaken through the participation of 76 middle-level engineering faculty members. The following are the significant suggestions for developing, training, and implementing needed courses in ethics: 1. Joint development of draft courses in ethics and validating them, 2. Preparation of case studies in ethics, 3. Preparation of educational video programs in ethics and televising them, 4. Preparation of MOOCs in ethics, 5. Offering Finishing School Programs, 6. Introduction of Industrial Visits where ethics are followed, 7. Conduct Seminars, Workshops, and Symposia on ethics for the faculty members, 8. Preparing Multi-Media Learning Packages (MMLPs) for Self-directed Learning of the Students, 9. Offering Research Projects and

Dissertation themes on Ethics, 10. Developing complete ethical guidelines for faculty recruitments, evaluation of performance, declaring probation completion, scaffolding them to undertake inter-disciplinary research and development projects, and bidding for complex projects under various International Development Agencies. If the faculty members are well trained in ethics, they can develop needed curricula by incorporating professional ethics which improve the attributes of the engineering graduates. They can ensure the safe planning and execution of various projects for society. This aspect is very important for ensuring the total safety of all engineering services and there is no shortcut.

6.1. Limitations of this Study

Faculty members from the southern states were alone sampled. The views of alumni, executives from SMEs, state-sponsored, companies and emeritus faculty members were not included in this study. Ancient moral standards were not incorporated.

6.2. Suggestions for Future Study

The graduates of India are very much in demand in multinational companies and they are also placed in various developed countries. Hence, the prevailing global ethical standards are to be included in the curricula. Many countries prescribe professional aspects in incorporating ethics to get professional engineering certificates. Hence, engineering institutes have to plan needed curricula in ethics and the faculty need to be trained to plan ethics for the graduates.

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