Engineering Technology in India

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Engineering Technology in India

Introduction

An engineering technologist is a specialist dedicated to the development, design, and implementation of engineering and technology in engineering field. It is generally expected engineering technologists often work under professional engineers. However, International Engineering Technologists Agreement (IETA) stipulates an engineering technology shall demonstrate "the competence for independent practice as an engineering technologist as exemplified by the International Engineering Alliance (IEA)[1] competency profile." IETA (Sydney Accord) provides knowledge profile for engineering technologists as: a systematic, theory- based understanding of the natural sciences applicable to the sub-discipline, conceptually-based mathematics, numerical analysis, statistics, and aspects of computer and information science to support analysis and use of models applicable to the sub-discipline, a systematic theory- based formulation of engineering fundamentals required in an accepted sub-discipline, engineering specialist knowledge that provided theoretical frameworks and bodies of knowledge for an accepted sub-discipline. In India engineering technologists are generally called diploma engineer and engineering technology education is delivered through vast network of "polytechnics." Polytechnics in India are junior colleges grants three year diploma and under the state councils of technical education[2]. The polytechnics are not part of any university systems.

Purpose

The primary purpose of this paper is to give an overview of engineering technology education system in India. To describe the state of technical education at the present time it is also needed to review historical perspective of technical education in India.

Historical Perspective of Technical Education in India

The impulse for creation of centers of technical training came from the British rulers of India and it arose out of the necessity for the training of overseers for construction and maintenance of public buildings, roads, canals and ports and for the training of artisans and craftsmen for the use of instruments and apparatus needed for the army, the navy and the survey department. The superintending engineers were mostly recruited from Britain from the Cooper's Hill College[1] and this applied as well to supervisors and artificers; but this could not be done in the case of lower grades- craftsmen, artisans and sub-overseers who were recruited locally. As they were mostly illiterate, efficiency was low. The necessity to make them more efficient by giving them elementary lessons in reading, writing, arithmetic, geometry and mechanics, led to the establishment of industrial schools attached to Ordnance Factories and other engineering establishments. While it is stated that such schools existed in Calcutta and Bombay as early as 1825, the first authentic account we have is that of an industrial school established at Guindy, Madras, in 1842, attached to the Gun Carriage Factory there. A school for the training of overseers was known to exist in Poona in 1854[2].

Meanwhile in Europe and America, Colleges of Engineering were growing up, which drew to their men having good education and special proficiency in mathematical subjects. This led to discussions in Government circles in India and similar institutions were sought to be established in the Presidency Towns. The first engineering college was established in the Uttar Pradesh in 1847 for the training of Civil Engineers at Roorkee, which made use of the large workshops and public buildings there that were erected for the Upper Ganges Canal. The Roorkee College (or to give it its official name, the Thomason Engineering College) was never affiliated to any university but gave diplomas considered to be equivalent to degrees. In pursuance of the Government policy, three Engineering Colleges were opened by about 1856 in the three Presidencies. In Bengal, a College called the Calcutta College of Civil Engineering was opened at the Writers' Buildings in November 1856; the name was changed to Bengal Engineering College in 1857, and it was affiliated to the Calcutta University. It gave a licentiate course in Civil Engineering. In 1865 it was amalgamated with the Presidency College. Later, in 1880, it was detached from the Presidency College and shifted to its present quarters at Sibpur, occupying the premises and buildings belonging to the Bishop's College. Proposals for having an Engineering College at Bombay city having failed for some reasons, the overseers' school at Poona eventually became the Poona College of Engineering and affiliated to the Bombay University in 1858. For a long time, this was the only College of Engineering in the Western Presidency. In the Madras Presidency, the industrial school attached to the Gun Carriage Factory became ultimately the Guindy College of Engineering and affiliated to the Madras University (1858). The educational work in the three Colleges of Sibpur, Poona and Guindy has been more or less similar. They all had licentiate courses in civil engineering up to 1880, when they organized degree classes in this branch alone. After 1880, the demand for mechanical and electrical engineering was felt, but the three Engineering Colleges started only apprenticeship classes in these subjects. The Victoria Jubilee Technical Institute, which was started at Bombay in 1887, had as its objective the training of licentiates in Electrical, Mechanical and Textile Engineering. In 1915, the Indian Institute of Science, Bangalore, opened Electrical Engineering classes under Dr. Alfred Hay and began to give certificates and associateships, the latter being regarded equivalent to a degree. In Bengal, the leaders of the Swadeshi Movement organized in 1907 a National Council of Education which tried to organize a truly National University. Out of the many institutions it started, only the College of Engineering and Technology at Jadavpur had survived. It started granting diplomas in mechanical and engineering course in 1908 and in chemical engineering in 1921.

The Calcutta University Commission debated the pros and cons of the introduction of degree courses in mechanical and electrical engineering. One of the reasons cited from the recommendations of the Indian Industrial Commission (1915), under the Chairmanship of Sir Thomas (Holland) against the introduction of electrical engineering courses, is given in the following quotation from their report: "We have not specifically referred to the training of electrical engineers, because electrical manufactures have not yet been started in India, and there is only scope for the employment of men to do simple repair work, to take charge of the running of electrical machinery, and to manage and control hydroelectric and steam-operated stations. The men required for these three classes of work will be provided by the foregoing proposals for the training of the various grades required in mechanical engineering. They will have to acquire in addition, special experience in electrical matters, but, till this branch of engineering is developed on the constructional site, and the manufacture of electrical machinery taken in hand,

the managers of electrical undertakings must train their own men, making such use as they can of the special facilities offered for instruction at the engineering colleges and the Indian Institute of Science.[2"]

The credit of first starting degree classes in mechanical engineering, electrical engineering and metallurgy goes to the University of Banaras, thanks to the foresight of its great founder, Pt. Madan Mohan Malaviya (1917). About fifteen years later, in 1931-32, the Bengal Engineering College at Sibpur started mechanical and electrical engineering courses in 1935-36 and courses in metallurgy in 1939-40. Courses in these subjects were also introduced at Guindy and Poona about the same time.

Quite a number of engineering colleges have been started since August 15, 1947. It is due to the realization that India has to become a great industrial country and would require a far larger number of engineers than could be supplied by the older institutions.

All India Council for Technical Education (AICTE)

The All India Council for Technical Education (AICTE) was set up in 1945 as an advisory body and later on in 1987 given the statutory status by an Act of Parliament. The AICTE grants approval for starting new technical institutions, for introduction of new courses and for variation in intake capacity in technical institutions. The AICTE has delegated to the concerned state governments powers to process and grant approval of new institutions, starting new courses and variations in the intake capacity for diploma level technical institutions. It also lays down norms and standards for such institutions. It also ensures quality development of technical education through accreditation of technical institutions or programs. In additional to its regulatory role, the AICTE also has a promotional role which it implements through schemes for promoting technical education for women, handicapped and weaker section of the society promoting innovations, faculty, research and development, giving grants to technical institutions.

The technical institutions under the AICTE include post-graduate, under-graduate and diploma in the whole spectrum of technical education covering engineering/technology, pharmacy, architecture, hotel management and catering technology, management studies computer applications and applied arts and crafts.
The AICTE has its headquarters in New Delhi and seven regional offices located at Kolkata, Chennai, Kanpur, Mumbai, Chandigarh, Bhopal and Bangalore. A new regional office at Hyderabad has been set up and is to be operational soon. The Council discharges its functions through an Executive Committee.

Current State of Engineering Technology in India

Engineering technologies in India are taught in “Polytechnic” colleges at the post-secondary level. They are usually three-year diploma program under the supervision of respective state board of technical education. These programs are kept outside the purview of university system. Often they are called Licentiate in Civil Engineering (LCE) or Licentiate in Mechanical

Engineering (LME) or licentiate in other disciplines of engineering. A diploma course in engineering involves classes on fundamental engineering concepts. It is a professional course, planned in such a way that students may still take up jobs in the field of engineering once they earn their diplomas. It can allow them to transfer into the second year of the B.Tech. or B.E. course. This, in effect, means the student may not have to take the eleventh and twelfth class exams. So, instead of the last two years of school and four years of the degree engineering course (a total of six years), the same qualification is achieved in the same amount of time with three years of a diploma course and three years of the degree course after the direct transfer. In India, engineering college admissions are controlled by national admission test or statewide admission tests. Engineering entrance exams like Joint Engineering Entrance test or individual state and college Common Entrance Tests can be bypassed by the diploma engineering graduates.

Diploma courses can be of a yearly or semester pattern. Most yearly pattern courses have a duration of three years. The diploma programs that follow a semester pattern have a planned duration of four years, with three years of study and one year for an industrial internship. The minimum qualification required for admission into a diploma course is passing of the Secondary School Leaving Certificate (SSLC)/tenth standard/equivalent examination, with science and mathematics. The state boards of technical education of most of the states in India conduct entrance tests for admission to the diploma programs offered by various polytechnics in the state.

A student who has attained the diploma is usually eligible to enter B.Tech./B.E. programs in the second year under a lateral entry scheme. This fast-track admission is possible only after writing the LET, the Lateral Entry Test. If they do well on this test, they can apply to B.Tech./B.E. programs.

The course content of the diploma program (see Appendix) and of the B.Tech./B.E. program is very similar, but the level of syllabus content is higher in the latter. Depth of the technical courses and level of use of mathematics in B,Tech/B.E. programs are much higher. However, diploma students may have an advantage, since they are likely to already have solid knowledge of fundamentals engineering courses like engineering graphics, applied mechanics, engineering materials etc. over regular B.Tech./B.E. students who directly enter after their twelfth grade.

Some colleges (or polytechnics) that offer the three-year diploma program in different streams of engineering are listed below:

1. Amrutvahini Polytechnic, Sangamner
2. Ghousia Polytechnic For Women, Karnataka
3. Guru Tegh Bahadur Polytechnic Institute
4. Hindustan Electronics Academy, HEA Polytechnic
5. Indira Gandhi Institute of Technology (IGIT), Sarang, Orissa
6. Jalpaiguri Polytechnic Institute
7. Jawaharlal Nehru Institute of Technology, Pune
8. MEI Polytechnic

A few of the popular diploma program in engineering are:

1. Diploma in Automobile Engineering
2. Diploma in Computer Science & Engineering
3. Diploma in Electronics and Communication Engineering (DETCE)
4. Diploma in Mechanical Engineering (DME)
5. Diploma in Aeronautical Engineering
6. Diploma in Information Science
7. Diploma in Civil Engineering (DCE)
8. Diploma in Electrical Engineering (DEE)
9. Diploma in Metallurgical Engineering
10. Diploma in Electronic Instrumentation & Control Engineering

Enrollments

According to AICTE[2], in 2016-17 there were 3925 polytechnic or diploma granting institutions in engineering/technology. Enrollments for 2016 were 583.496 males and 113,264 female students. Typically, 70% of the students who enrolls graduate from these programs. There were 121,216 faculty members in the polytechnic system.

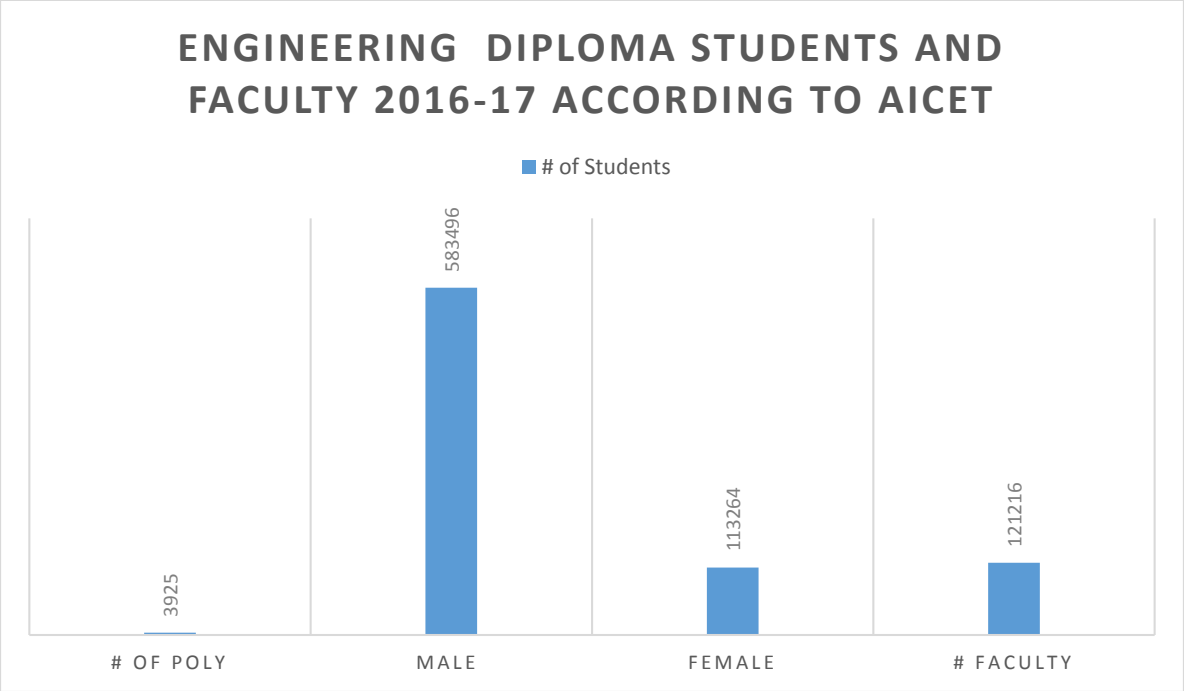

Figure 1: Enrollment and Faculty Numbers in Diploma Granting Institutions

Job Prospects for Diploma Engineering Graduates

Graduates from the diploma engineering programs are typically hired as junior engineers in private sector. A few companies have engineering technology and designer designation. Many state governments hire diploma holder as Sub-Assistant Engineer. Majority of the polytechnics claims over 90% of the graduates receives job offer within six month of graduation[2]. However there is no verifiable source exist to support these claims.

Conclusion

Engineering technology education, that is diploma engineering in India, is thriving in the sub-continent. Great influx of technical manpower that was needed to build India's civil and information infrastructure since mid-nineties has helped the diploma granting polytechnics grow and modernize their programs and facility.

References

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Appendix[2]

Sample of model curriculum for Diploma Engineering (Mechanical)

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION											
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES											
COURSE NAME: ELECTRONICS/MECHANICAL/CIVIL/COMPUTER/ELECTRICAL/CHEMICAL ENGG.											
COURSE CODE : EJ/EN/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/EE/EP/CH/CT/PS/ CD/EDEI/											
DURATION OF COURSE : 6 SEMESTERS											
SEMESTER: FIRST									SCHEME : C		
BRANCH: Common for all branches SEMISTE											
SR.NO.	SUBJECT	PERIODS			EVALUATION SCHEME						Credits
	THEORY	L	TU	PR	SESSIONSAL EXAM			ESE	PR #	TW @	
					TA	CT	Total				
1	Basic Physics	2	-	2	10	20	30	70	50	-	3
2	Basic Chemistry	2	-	2	10	20	30	70	50	-	3
3	Basic Mathematics	4	1	-	10	20	30	70	-	-	5
4	English	2	-	2	10	20	30	70	-	25	3
5	Engineering Graphics	2	-	4	-	-	-	-	-	50	4

6	Computer Fundamentals	1	-	4	-	-	-	-	50	25	3
7	Basic Workshop Practice (Group wise)	-	-	3	-	-	-	-	50	25	2
	Total	**13**	**1**	**17**	**40**	**80**	**120**	**280**	**200**	**125**	**23**

STUDENT CONTACT HOURS PER WEEK: **31 HRS**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH

- External Assessment @ - Internal Assessment ESE - End Semester Exam.

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, TU - Tutorial, PR - Practical TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.

Total Marks : 725

Assessment of Practical, Oral & term work to be done as per the prevailing norms of curriculum implementation & assessment

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION												
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES												
COURSE NAME: MECHANICAL ENGINEERING												
COURSE CODE : ME/PG/AE/PS/MH/FE/MI												
DURATION OF COURSE : 6 SEMESTERS												
SEMESTER: SECOND											**SCHEME : C**	
Sr.No.	**SUBJECT**	**PERIODS**			**EVALUATION SCHEME**							**Credits**
	THEORY	**L**	**TU**	**P**	**SESSIONSAL EXAM**			**ESE**	**PR @**	**Oral #**	**TW @**	
					TA	**CT**	**Total**					
1	Communication Skills	1	1	2	10	20	30	70	-	25	25	3
2	Engineering Mathematics	3	1	-	10	20	30	70	-	-	-	3
3	Applied Science (Mechanical & Plastic)	3	-	4	10	20	30	70	50	-	-	5
4	Engineering Mechanics	3	-	2	10	20	30	70	-	-	25	4
5	Workshop Drawing	1	-	4	10	20	30	70	-	-	50	3
6	Workshop Practice	-	-	4	-	-	-	-	-	-	50	2
7	Development of Life – I	1	-	2	-	-	-	-	-	25	25	3
8	Professional Practices-II	-		2					-		50	1
Total		**12**	**2**	**20**	**50**	**100**	**150**	**350**	**50**	**50**	**225**	**24**

STUDENT CONTACT HOURS PER WEEK: **34 HRS**
HTEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH
, External Assessment @ , Internal Assessment ESE – End Semester Exam.

ABBREVIATIONS: CT- Class Test, TA – Teachers Assessment, L – Lecture, TU – Tutorial, P – Practical
TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.
Total Marks : 675

Assessment of Practical, Oral & term work to be done as per the prevailing norms of curriculum implementation & assessment.

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION												
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES												
COURSE NAME: MECHANICAL ENGINEERING												
COURSE CODE : ME/PG/PT/AE/PS/MH/FE/MI												
DURATION OF COURSE : 6 SEMESTERS												
SEMESTER: THIRD										**SCHEME : C**		
Sr.No.	**SUBJECT**	**PERIODS**			**EVALUATION SCHEME**							**Credits**
	THEORY	**L**	**TU**	**PR**	**SESSIONSAL EXAM**			**ESE**		**Oral #**	**TW @**	
					TA	**CT**	**Total**					
1	Applied Mathematics	3	1	-	10	20	30	70		-	-	4
2	Mechanical Engineering Drawing	3	-	4	10	20	30	70		25	25	5
3	Strength of Materials	2	-	2	10	20	30	70		-	25	3
4	Mechanical Engineering Materials	3	-	-	10	20	30	70		-	-	3
5	Electrical Engineering	2	-	2	10	20	30	70		-	-	2
6	Manufacturing Technology		-	4	-	-	-	-		-	25	3
7	Development of life Skill – II	-	-	2	-	-	-	-		25	25	1
8	Professional Practices-III	-		3							50	2
Total		**13**	**1**	**17**	**50**	**100**	**150**	**350**		**50**	**150**	**23**

STUDENT CONTACT HOURS PER WEEK: **31 HRS**
HTEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH
, External Assessment @ , Internal Assessment ESE - End Semester Exam.

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, TU - Tutorial, PR - Practical
TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.
Total Marks : 700

Assessment of Practical, Oral & term work to be done as per the prevailing norms of curriculum implementation & assessment.

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION												
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES												
COURSE NAME: MECHANICAL ENGINEERING												
COURSE CODE : ME/MH/MI												
DURATION OF COURSE : 6 SEMESTER												
SEMESTER: FOURTH											**SCHEME : C**	
Sr.No.	**SUBJECT**	**PERIODS**			**EVALUATION SCHEME**							**Credits**
	THEORY	**L**	**TU**	**P**	**SESSIONSAL EXAM**			**ESE**	**PR @**	**Oral #**	**TW @**	
					TA	**CT**	**Total**					
1	Theory of Machines & Mechanisms	3	-	2	10	20	30	70		-	25	4
2	Fundamentals of Electronics	3	-	2	10	20	30	70		-	-	4
3	Production Processes	1	-	3	10	20	30	70		-	25	3
4	Thermal Engineering	3	-	2	10	20	30	70		25	25	4
5	Fluid Mechanics and Machinery	3	-	2	10	20	30	70		25	25	4
6	Computer Programming	1	-	2	-	-	-	-		-	-	2
7	Professional Practices - IV	-	-	3	-	-	-	-		-	50	2
	Total	**14**	**0**	**17**	**50**	**100**	**150**	**350**		**50**	**150**	**23**

STUDENT CONTACT HOURS PER WEEK: **31**
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH
, External Assessment @ , Internal Assessment ESE - End Semester Exam.

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, TU - Tutorial, P - Practical
TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.
Total Marks : 700

Assessment of Practical, Oral & term work to be done as per the prevailing norms of curriculum implementation & assessment.

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION												
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES												
COURSE NAME: MECHANICAL ENGINEERING												
COURSE CODE : ME/MH/MI												
DURATION OF COURSE : 6 SEMESTER												
SEMESTER: FIFTH										**SCHEME : C**		
Sr.No.	**SUBJECT**	**PERIODS**			**EVALUATION SCHEME**							**Credits**
	THEORY	**L**	**TU**	**P**	**SESSIONSAL EXAM**			**ESE**		**Oral #**	**TW @**	
					TA	**CT**	**Total**					
1	Advanced Manufacturing Processes	3	-	2	10	20	30	70		-	25	4
2	Power Engineering	3	-	2	10	20	30	70		-	-	4
3	Measurements & Control	3	-	2	10	20	30	70		-	25	4
4	Metrology & Quality Control	4	-	2	10	20	30	70		25	25	4
5	ELECTIVE	-	-	-	10	20	30	70		25	25	4
	Tool Engineering			2								
	Automobile Engineering			2								
	Power Plant Engineering			2								
	Mechatronics			2								

6	Industrial Project & Entrepreneurship	-	-	2	-	-	-	-		-	-	2
7	Professional Practices – V	-	-	3	-	-	-	-		-	50	2
	Total	**13**	**0**	**17**	**50**	**100**	**150**	**350**		**50**	**150**	**24**

STUDENT CONTACT HOURS PER WEEK: **30**

HTEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH

, External Assessment @ , Internal Assessment ESE - End Semester Exam.

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, TU - Tutorial, P - Practical

TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.

Total Marks : 700

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION												
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES												
COURSE NAME: MECHANICAL ENGINEERING												
COURSE CODE : ME / MH / MI												
DURATION OF COURSE : 6 SEMESTERS												
SEMESTER: SIXTH SEMESTER										**SCHEME : C**		
Sr.No.	**SUBJECT**	**PERIODS**			**EVALUATION SCHEME**							**Credits**
	THEORY	**L**	**TU**	**PR**	**SESSIONSAL EXAM**			**ESE**	**PR**	**Oral #**	**TW @**	
					TA	**CT**	**Total**					
1	Management	03	--	--	10	20	30	70	--	--	--	3
2	Design of Machine Elements	04	--	02	10	20	30	70	--	25	25	5
3	Industrial Fluid Power	03	--	02	10	20	30	70	--	25	25	4
4	Production Technology	03	--	--	10	20	30	70	--	--	--	3
5	**Elective II (Any One)**											
	Alternate Energy Sources & Management $	03	--	02	10	20	30	70	--	--	25	4
	Material Handling Systems	03	--	02	10	20	30	70	--	--	25	4
	Refrigeration & Air-Conditioning	03	--	02	10	20	30	70	--	--	25	4
	CAD-CAM & Automation	03	--	02	10	20	30	70	--	--	25	4
6	Industrial Project	--	--	06	--	--	--	--	--	50#	50	3

7	Professional Practices - VI	--	--	04	--	--	--	--	--	--	50@	2
	Total	**16**	**--**	**16**	**50**	**100**	**150**	**350**	**--**	**100**	**175**	**24**

STUDENT CONTACT HOURS PER WEEK: **32**
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH
, External Assessment @ , Internal Assessment ESE - End Semester Exam.

ABBREVIATIONS: CT- Class Test, TA - Teachers Assessment, L - Lecture, TU - Tutorial, P - Practical
TA: Attendance & surprise quizzes = 6 marks. Assignment & group discussion = 4 marks.
Total Marks :775