

## **AC 2008-432: ENGINEERING EDUCATION EXCELLENCE: START-UP TO NUMBER ONE**

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# **Engineering Education Excellence – Start-up to Number One**

## **Abstract**

An amazing event has occurred in India where Vellore Institute of Technology (VIT), started in 1984, became the top private university in engineering as rated by India Today. VIT University started as Vellore Engineering College in 1984 with 180 students and little growth occurred during its first nine years. During the next seven years the infrastructure expanded rapidly, quality education was emphasized and graduate programs were started. In the last seven years VIT became a deemed university, continued adding infrastructure and starting new graduate programs, started a business school and implemented a continuous improvement quality management system. For the 2007-2008 year VIT University had over 88,000 applications for its Bachelor of Technology Programs, but could accept only 2,234 students due to facility and staff capacity limitations. The total number of new students for 2007-2008 in all undergraduate and graduate programs was more than 4,400 and the total university enrollment exceeds 12,000 students.

## **Introduction**

The two main ingredients for new universities emerging as leaders have been a commitment of leadership and a commitment to quality. One author has observed two start-up universities which have achieved outstanding success and they are Aalborg University (AAU), which was started in 1974 in Denmark and VIT University which was started in 1984 in Vellore, India. In both cases the universities had strong leaders who served as rector (AAU) or chancellor (VIT) for approximately 25 years and both leaders had strong support from the faculty and staff. Sven Caspersen was the rector at Aalborg University which focused upon project based education and AAU became the world leader in that type of educational system. Govindasamy Viswanathan was founder and chancellor of VIT University and focused upon assuring quality in the education system. Previous papers have presented the Aalborg Educational system<sup>1,2,3</sup> and this paper will focus on VIT University.

## **VIT University Background**

The keys to the success of VIT University have been the leadership of Mr. Viswanathan and his commitment to quality at the university. His BS and MS degrees were in economics followed by a law degree. He was a popular leader with oratory skills, and was elected to the Indian Parliament and served from 1967-1977. He later served as a member of the state legislature of Tamil Nadu during 1980-1984 and again in 1991-1996. During his second term in the state legislature he also served as a Minister in the Government of Tamil Nadu. These

political connections were helpful in establishing a private university in 1984. During his 1980-1984 term in the legislature he continued his request to start an engineering college in Vellore. Finally in 1984, the State Education Minister informed him that private Engineering Colleges were to be permitted in Tamil Nadu. He obtained help from Professor N. Lalitha to draft a project proposal for establishing Vellore Engineering College under the aegis of the North Arcot Educational and Charitable Trust. The college was approved in September 1984 and 150 acres of land was designated for the college which belonged to the state government. In September of 1985 the government land was given to the trust and the first building was started. Vellore Engineering College moved to its present location in 1985 and now VIT University has 300 acres of land with newly constructed facilities as shown in Figure 1.



Figure 1. Aerial View of VIT University Campus Illustrating Its New Infrastructure.

VIT was affiliated to the University of Madras and the degrees were awarded by the University of Madras until June 2001, when VIT was conferred Deemed University status by the Ministry of Human Resource Development of the Government of India. The Deemed University status permitted VIT to award its degrees directly. In 2007, the name of Vellore Institute of Technology, Deemed University was changed to VIT University.

The first three programs in 1984 were for Civil, Mechanical and Electronics and Communication Engineering with a limit of 60 students per program. The first graduates came four years later in 1988. The entering enrollment over the first 9 years was nearly constant at 180 students per year. During the 1991-1995 period, the Chairman's activities were executed by Sankar Viswanathan. Govindasamy Viswanathan<sup>4</sup> returned as Chairman in 1995 and VIT began to significantly increase its programs and enrollment. There were many difficulties (financial and political) in the early years, especially during 1990-1993, but stability arrived in the fall of 1993. Additional programs were started in 1993 and by 2007 there were 18 different undergraduate

programs and 31 master programs in six different schools. The schools and programs are listed in Table 1.

Additional undergraduate engineering programs were started in 1993, the first MS programs started in 1994, the M. Technology started in 1995, and the Master of Philosophy and PhD research programs were started in 2003. The admissions for the various engineering programs through the first 24 years are presented in Table 2 and the graduations rates for those

**Table 1. Schools and Programs at VIT University in 2007**

<b>School</b>	<b>Undergraduate Programs</b>	<b>Graduate Programs (MS, M. Tech., M. Software, MCA, MBA)</b>
School of Mechanical and Building Sciences	Mechanical Engineering Civil Engineering Mechanical and Energy Engineering	Automotive Engineering Computer Aided Design / Computer Aided Manufacturing Energy and Environmental Engineering Mechatronics Structural Engineering
School of Electrical Sciences	Electrical and Electronics Engineering Electronics and Communication Engineering Electronics and Instrumentation Engineering Telecommunication Engineering	Automotive Electronics Communication Engineering Nanotechnology Power Electronics Sensor System Technology VLSI Design
School of Computing Sciences	Computer Science and Engineering Information Technology Computer Applications Computer Science	Computer Science and Engineering Information Technology - Networking Computer Applications Software Engineering Computer Science
School of Biotechnology, Chemical and Biomedical Engineering	Bioinformatics Biotechnology Chemical Engineering Microbiology	Biotechnology Biomedical Engineering Applied Microbiology Biomedical Genetics Biotechnology
School of Science and Humanities		Pharmaceutical Chemistry Chemistry – Organic / Inorganic / Analytical Physics
VIT Business School	Commerce with Computer Applications	Master of Business Administration International Business

**Table 2. Enrollment Statistics for VIT University**

<b>Starting Year</b>	<b>School Year</b>	<b>B. Tech. Programs</b>	<b>M. Tech. Programs</b>	<b>Bachelor Programs*</b>	<b>Master Programs**</b>	<b>Total New Students</b>
1	1984 - 85	180				180
2	1985 - 86	180				180
3	1986 - 87	180				180
4	1987 - 88	180				180
5	1988 - 89	180				180
6	1989 - 90	180				180
7	1990 - 91	180				180
8	1991 - 92	178				178
9	1992 - 93	175				175
10	1993 - 94	281				281
11	1994 - 95	344			69	413
12	1995 - 96	381	32		70	483
13	1996 - 97	393	32		88	513
14	1997 - 98	406	32		121	559
15	1998 - 99	451	50		116	617
16	1999 - 00	648	50		114	812
17	2000 - 01	567	32		122	721
18	2001 - 02	937	142	55	310	1444
19	2002 - 03	879	317	240	370	1806
20	2003 - 04	1052	358	376	592	2378
21	2004 - 05	1305	330	462	748	2845
22	2005 - 06	1456	435	446	837	3174
23	2006 - 07	1850	549	424	1012	3835
24	2007 - 08	2153	533	392	1312	4390

\* All Programs other than Bachelor of Technology

\*\* All Programs other than Master of Technology

programs are listed in Table 3. The graduation rate is over 98 percent for the Bachelor and Master of Technology Programs with the students graduating on schedule. Table 3 indicates that the emphasis is on technology programs and Table 2 indicates that all programs except the School of Business emphasize science and technology. The graduation rate for the three year bachelor programs appears to be over 87 percent. These are high graduation rates compared to most universities<sup>5</sup> in the USA which tend to lose approximately 30 percent of the engineering students as they leave the university or transfer to other programs during the first two years.

One reason for the high graduation rates can be explained by the ability to select the best students. The number of applications and admissions illustrated in Table 4 indicate that highly qualified students can be selected as the pool of applications is very high, especially in the Bachelor of Technology programs where less than 3 percent of the applicants are admitted to the programs. The other programs admit approximately 25 percent of applicants, but this still is a good pool of applicants for each student admitted. This also exhibits the confidence the students and parents have with VIT University. More than 97% of the recent applicants were denied admission to the Bachelor of Technology programs because of faculty and facility capacity limitations and not because of their academic abilities. Indirectly, this gives an immense potential for its growth. From the enrollment statistics in Table 2, there was an average growth of nearly 500 students per year in the enrollments since the 2000-2001 academic year.

### **Remarkable Achievement**

A significant acknowledgment of the academic achievement of VIT University was its overall ranking in the June 4<sup>th</sup>, 2007 issue of India Today<sup>6</sup> as the 14<sup>th</sup> Engineering School in India. There are more than 18,400 colleges and universities in India and these were reduced to 1,400 and then short listed to 600. The shortlist involved contacting 360 experts comprising principals, department heads and deans to reduce the list of 1,400 to 600. Another 540 experts were interviewed to rank the colleges on the basis of seven parameters – Reputation, Curriculum, Quality of Academic Input, Student Care, Admission Procedure, Infrastructure, and Job Prospects. These formed the Perceptual Rank which accounted for 70 percent of the overall ranking. In the perceptual criteria, VIT University was ranked 18<sup>th</sup> in the nation. The Factual Rank was based upon information collected from the colleges based upon infrastructure, placements and faculty, which accounted for the remaining 30 percent of the overall ranking. In the factual criteria VIT University was ranked 6<sup>th</sup> in the nation which was higher than three of the very prestigious IIT universities. One reason for the high factual ranking is the commitment for job placement of its graduates as over 90 percent have offers before or soon after graduation. This is extremely high for universities in India. VIT University was the highest ranked private university and 14<sup>th</sup> overall in the nation; this is a spectacular accomplishment for a university less than 25 years old.

**Table 3. Graduation Statistics for VIT University**

<b>School Year</b>	<b>B. Tech. Programs</b>	<b>M. Tech. Programs</b>	<b>Bachelor Programs*</b>	<b>Master Programs**</b>	<b>Master of Philosophy and PhD</b>
<b>1988</b>	<b>180</b>				
<b>1989</b>	<b>180</b>				
<b>1990</b>	<b>180</b>				
<b>1991</b>	<b>180</b>				
<b>1992</b>	<b>180</b>				
<b>1993</b>	<b>180</b>				
<b>1994</b>	<b>180</b>				
<b>1995</b>	<b>178</b>				
<b>1996</b>	<b>175</b>			<b>40</b>	
<b>1997</b>	<b>281</b>	<b>32</b>		<b>69</b>	
<b>1998</b>	<b>344</b>	<b>32</b>		<b>88</b>	
<b>1999</b>	<b>381</b>	<b>32</b>		<b>89</b>	
<b>2000</b>	<b>393</b>	<b>50</b>		<b>121</b>	
<b>2001</b>	<b>406</b>	<b>50</b>		<b>112</b>	
<b>2002</b>	<b>451</b>	<b>32</b>		<b>118</b>	
<b>2003</b>	<b>648</b>	<b>142</b>		<b>215</b>	<b>7</b>
<b>2004</b>	<b>558</b>	<b>309</b>	<b>49</b>	<b>267</b>	<b>6</b>
<b>2005</b>	<b>838</b>	<b>353</b>	<b>212</b>	<b>461</b>	<b>5</b>
<b>2006</b>	<b>854</b>	<b>327</b>	<b>328</b>	<b>527</b>	<b>7</b>
<b>2007</b>	<b>1035</b>	<b>430</b>	<b>395</b>	<b>696</b>	<b>5+7***</b>

\* All Programs other than Bachelor of Technology

\*\* All Programs other than Master of Technology

\*\*\* PhD Students

**Table 4. Application and Admission Rates for 2005-2007 for Undergraduate and Graduate Programs**

<b>Academic Year</b>	<b>2005-2006</b>		<b>2006-2007</b>		<b>2007-2008</b>	
<b>Programs</b>	Applications	Admitted	Applications	Admitted	Applications	Admitted
<b>Undergraduate</b>						
Bachelor of Technology	43,732	1,453 (3.3%)	82,980	1,764 (2.1%)	88,446	2,156 (2.4%)
All Other Bachelor Programs	1,730	460 (27%)	1,819	422 (23%)	2,234	504 (23%)
<b>Graduate Programs</b>						
Engineering	3,893	1,144 (29%)	7,226	1,371 (19%)	5,597	1,536 (27%)
Business School	470	166 (35%)	988	181(18%)	916	181 (21%)

### **Successful Driving Forces of VIT University**

The success of VIT University has resulted from the commitment of Mr. Viswanathan to develop a quality education system. The character of the university is noted by its motto, mission, vision and quality statements which are:

Motto: VIT – A place to learn; A chance to grow.

Mission: Our mission is to educate students from all over India, including those from the local and rural areas, and from other countries so that they become enlightened individuals, improving the living standards of their families, industry and society. We will provide individual attention, world-class quality of education and take care of character building.

Vision: We, at Vellore Institute of Technology, will impart futuristic technical education and instill high patterns of discipline through our dedicated staff who shall set global standards, making our students technologically superior and ethically strong, who in turn shall improve the quality of life of the human race.



Quality Policy: We, at Vellore Institute of Technology, aspire to establish a system of Quality Assurance which would on a continuous basis evaluate and monitor the quality of education and training imparted at the Institute, improve the teaching-learning process and, ultimately, develop the Institute as a Center of Excellence.

Few universities have made such strict commitment to quality and quality assurance in education. This is one of the primary causes for the rapid successful rise of VIT University.

## **Discipline and Ethics**

Another factor in the high graduation rate is the strict discipline which occurs at the university. The rules for behavior in the classroom and on campus are very strict compared to the typical university in the USA. VIT University believes that good discipline is necessary to achieve academic laurels. As stated in the student Hand Book & Calendar 2007-2008<sup>7</sup>, some of the discipline statements are:

- a) Students are required to maintain not only good academic progress but maintain a high level of discipline on campus.
- b) Any student found indulging in ragging will be EXPELLED from the University and could be handed over to the police. (There is a 2 year prison penalty according to Government Rules)
- c) Smoking and Drinking are prohibited inside the campus/hostels.
- d) Student must maintain a decent dress code.
- e) Students must switch cell phones to off during class hours, laboratory sessions in the library and at meeting places. Camera cell phones are prohibited on campus.
- f) Students are to be punctual for all classes as well as for guest lectures and meetings.
- g) Students are to stay until the end of meetings/seminars.
- h) Students are to give due respect to prayer song, national anthem, faculty, staff and other elders.
- i) Students are to conserve energy by switching off fans and lights when not in use.
- j) A minimum of 75% attendance in each subject is necessary to write the Continuous Assessment Examinations (Midterms). Students with less than 75% attendance in each subject in a semester will have to re-register the subject in the next academic year. For the theoretical courses there are two Continuous Assessment Examinations which each are 15% of the final grade and the final examination accounts for 50% of the final grade. The other 20 percent is for quizzes, projects, and etc.

The strict discipline and respect for fellow students, staff and faculty improves the learning environment and eliminates many of the problems that occur in universities with large classes in the USA. This prevents students from distracting other students and provides a better learning environment. The high percentage for the final examination forces the students to

concentrate on reviewing the semester's material, whereas most final exams in the USA are less than thirty percent of the final grade, which often doesn't have a large effect on the final grade for the course.

Ethics and academic integrity are also emphasized at VIT University and they have internally published a primer<sup>8</sup> to help their professors and instructors to improve their instruction. This primer is an excellent book of 21 chapters including topics such as lecturing, questioning techniques in the classroom, discussions in the classroom, teaching with the case method or case studies, group work, assessing student's performance, creating a positive environment and etc. Ethics and ethical situations are presented as well as academic integrity between faculty and students. The primer indicates various potential types of academic fraud and dishonesty.

### **Quality Assurance for the VIT University Education System**

VIT University recognized that it had to prove that it had a quality education programs and not only state that it wanted quality programs. In 1988, when the first batch of students completed their programs, some of the students obtained Gold Metals and Ranks from the University of Madras, which was the institution that awarded the degrees. In that year all three engineering programs were accredited by the National Board of Accreditation of the All India Council for Technical Education with a "A" grade.

In 1999, VIT was the first engineering college in India to get the coveted ISO:9002 Certification from DNV(Den Norske Veritas), The Netherlands. This led to the establishment of a continuous quality improvement system which helped the university be granted Deemed University status by the Government of India in 2001. This permitted VIT University to award its own degrees whereas previously they were awarded under the auspices of the University of Madras.

In its continuing quest for quality, five of the technology engineering programs were accredited by the Energy Institute according to Engineering Council (UK). In 2004, the first TVN-KIDAO-NIQR Award for Outstanding Educational Institution by the National Institution for Quality and Reliability was presented to VIT University. In 2005 it had its programs accredited by The Institution of Engineering and Technology (UK) and VIT University was the first university in India to be accredited by The IET. Similarly, in 2006, Energy Institute (UK), audited and accredited some of the engineering programs. Future goals of VIT University are to have its engineering programs accredited through ABET (Accreditation Board of Engineering and Technology) and the business programs accredited through the AACSB (American Association of Collegiate Schools of Business).

VIT University has established university general goals and goals that are student and faculty oriented to improve the educational system. Some of the established goals are:

#### General Goals

- ▼ To become a World Class University.
- ▼ To be a Total Quality Management Institution.
- ▼ To maintain a good teacher-student ratio.
- ▼ To have the latest facilities matching and exceeding that of industry.

#### Student Oriented Goals

- ▼ To provide high-quality technical education.
- ▼ To facilitate the students to learn well and excel in examinations.
- ▼ To build good personality traits in students like honesty, punctuality, integrity and discipline.
- ▼ To help the students excel in communication skills.
- ▼ To improve the creativity, leadership qualities, organizing skills and entrepreneurial skills of the students to become successful entrepreneurs.
- ▼ To help students excel in extra-curricular activities.
- ▼ To make effective systems for 100% placement of the students.

#### Faculty Oriented Goals

- ▼ To encourage faculty in the development of new processes, products, systems and technologies leading to innovations, patents and publications at the national and international level.
- ▼ To encourage faculty to acquire higher qualifications and carryout research.
- ▼ To help faculty members excel in teaching skills.
- ▼ To help faculty members in their career growth.
- ▼ To care for the health and welfare of the faculty, staff and their families.

#### Sustainable Growth

The sustainable growth of VIT University can be attributed not only to Mr. Viswanathan's commitment but also to the support extended by his sons as Pro-Chancellors to ensure constant interaction with students, faculty and staff and ascertain their needs and satisfaction. The transparent faculty selection process helps to ensure that the best faculty are recruited. Higher scales of pay and motivation to growth are used to retain them. Planned additions of infrastructure, equipment, information resources and modernization of existing resources were performed to maintain the growth momentum. Exceptional performance has resulted in numerous research grants from government and from industry leaders. Presently VIT University has over 100 million Rupees (Approximately 2.5 million US Dollars) worth research

projects. One of the key facility showcases is Technology Tower which was opened in 2004 and is shown in Figure 2.



Figure 2. Technology Tower – Centerpiece of the Engineering Infrastructure at VIT University

A significant contribution for VIT's success comes from its campus placement services. Over 90% of the graduates are placed across the globe in leading IT companies and other industry leaders. Similarly, its strong international linkage with many distinguished universities across the world helps it grow synergistically. A summary of important milestones in the growth of VIT University is presented in Table 5.

## Summary and Conclusions

VIT University started as Vellore Engineering College in 1984 and had little growth in admissions and a financial crisis during the first nine years. During the next seven years Vellore Institute of Technology admissions enrollment more than doubled, the infrastructure was rapidly expanding, the focus on quality education was emphasized and several graduate programs started. The last seven years VIT University became a deemed university, had the admissions enrollment quadruple to nearly 4,400 students, added significant infrastructure, started the business school and several new graduate programs, implemented the quality management system and was the highest ranked private engineering university and was the ranked 14<sup>th</sup> when compared to all engineering universities in India.

Few universities have made such a sincere commitment to quality and implemented it with strict discipline; high ethical standards; establishment of general goals, faculty and student oriented goals; focus on student placement; and the development of excellent faculty primer for

**Table 5. Key Milestones in the Growth of VIT University**

1984	Establishment of Vellore Engineering College affiliated to University of Madras, Chennai
1985	Construction of G. D. Naidu Block – First building of Vellore Engineering College
1988	With passing of first batch of students, all Engineering Programmes were Accredited by NBA (National Board of Accreditation), constituted by AICTE with 'A' Grade.
1994	Commencement of Postgraduate Programmes
1998	Establishment of (i) Administrative Block and (ii) M. Visveswaraiah Block
1999	First Engineering College in India to get the coveted ISO: 9002 Certification
2001	Grant of Deemed University status by University Grants Commission and Ministry of Human Resource Development, Government of India and the Vellore Engineering College rechristened as "Vellore Institute of Technology". Opening of Periyar E.V.R. Central Library (fully air-conditioned)
2002	Centenarian's Seva Ratna Award 2001 presented to VIT University Chancellor by the Centenarian Trust, Chennai.
2003	Certification by NAAC (National Assessment and Accreditation Council), a body constituted by UGC (University Grant Commission), Government of India, New Delhi, with an institutional score of 75 % - 80 %.  Accreditation of B.E. and B.Tech. Programmes conducted at VIT (Deemed University) by the Institutions of Engineers (India)  Commissioning of Bio-process plant, Energy centre and zero-waste management programme and establishment of Academic Staff College
2004	EXNORA Green Campus Award presented to VIT by EXNORA International Chennai. Inauguration of Technology Tower – Multi-storey Building, Trendset – An air-conditioned state-of-the-art Gym
2005	Outstanding Educational Institution Award TVN-KIDAO-NIQR Award presented to VIT by NIQR (National Institution of Quality and Reliability), a consortium of leading industries and organizations.  All Engineering and Technology courses (Under - Graduate and Post – Graduate) have been Accredited by IET (Institution of Engineering and Technology), U.K.  Establishment / Inauguration of: (i) Centre for Bioseparation Technology (CBST) (ii) Technology Business Incubator (TBI) (iii) TIFAC-CORE in Automotive Infotonics (iv) Centre for Sustainable and Rural Development & Research Studies (CSRD & RS) and (v) Mother Theresa Ladies Hostel
2006	"Connect Achiever Award 2006" conferred on VIT for establishing excellent infrastructure promoting IT (Information Technology) education by C.I.I. (Confederation of Indian Industries).  Civil Engineering, Chemical Engineering and Energy related Engineering Degree Programmes have been accredited by the Energy Institute. U.K.  Establishment / Inauguration of: (i) Centre for Disaster Mitigation and Management (CDMM) (ii) Jhansi Rani Block – Ladies Hostel, and (iii) Automotive Research Centre  Scroll of Honour presented to VIT University for outstanding contribution to establish the CDMM (Centre for Disaster Mitigation and Management) and for providing expert facility for South Asia, by Safety and Quality Forum, The Institution of Engineers (India) at New Delhi.
2007	Name of Vellore Institute of Technology, changed to "VIT University" as per the instructions of University Grants Commission, Government of India.  "India Today" a leading Magazine of India ranked VIT University as 14 <sup>th</sup> as per the All India Ranking of Top most Engineering Colleges / Institutions in India (which is number one among the private Universities / Institutions).

new faculty. This commitment to quality has helped launch the rapid success and recognition of VIT University as a leading engineering school in India.

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