

# **AC 2009-636: CIVIL ENGINEERING EDUCATION AT THE MAHARAJA SAYAJI RAO UNIVERSITY OF BARODA, INDIA AND AT THE UNIVERSITY OF FLORIDA**

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## **Abstract**

Civil engineering is one of the oldest branch of engineering that includes planning, design, construction, operation, and maintenance of infrastructure. This include roads, airports, railroads, buildings, bridges, canals, harbors, terminals, Power plants, nuclear reactors, towers, water and wastewater treatment plants, sewers, drainage, flood control, water supply, landfills, and many other facilities.

With the advancement of technology and the use of computers, civil engineering has now no limits. From tall sky scrapper in the sky to the tunnels beneath the sea, civil engineering has touched new horizons. Without Civil engineering, today's world and life would have been a mere imagination. And so today's civil engineers along with thorough knowledge of basic concepts should also have to be updated with new studies, the latest technology and advancement in the field.

The course structure and curriculum of the universities producing civil engineers should be in accordance with the Civil engineering requirement of today. The structure, curriculum and the evaluation methods at the Maharaja Sayaji Rao University of Baroda, situated in Gujarat state of India is a bit different from the one at the University of Florida. It has four years undergraduate program which consist of eight semesters, two semesters each year, and the curriculum, includes mainly the fundamental concepts with the less use of the computers, the evaluation and the exams system also differ from the University of Florida in various ways.

The paper deals with the in depth study about the curriculum, examination and evaluation methods, at the Maharaja Sayaji Rao University of Baroda and at University Of Florida. The Result of the paper shows advantages and disadvantages of the excessive use of computers, online evaluation and assessment system, distance learning programs. With all this, it highlights some of the possible modification in such areas so that it can satisfy the educational requirement of both the countries and the requirements of today's civil engineering.

## **Introduction**

The Maharaja Sayajirao University of Baroda, named after Maharaja Sayajirao Gaekwad, one of the visionary rulers of Baroda, is one of the renowned universities of India and the largest university in Gujarat state of India. It is well known throughout Asia for the Faculty of fine Arts, Technology and Engineering and many more. The Faculty of Technology and Engineering and the Faculty of Science are the best in Gujarat. This distinguished institute for education, Established in 1881, was originally known as Baroda College of Science. It was recognized as a university in 1949 after the independence of the country, It is both teaching and residential university in the sense that it offers all its courses under a single roof. It is the only university. In the present day, the university has more than 15 different colleges including college of

engineering, college of medicine, college of performing arts and many more with approximately 35000 students every year<sup>1,2</sup>.

Florida's largest and the United State's fourth largest, University of Florida was founded in 1853, and has been recognized as a "Public Ivy". UF is currently ranked 49th overall among national universities in the 2009 *U.S. News & World Report* rankings. The University of Florida is one of the largest universities in the United States, with 51,913 students as of fall 2007. It has one of the biggest budgets in the United States at nearly \$4.377 billion per year. Florida has 17 colleges and more than 100 research, service and education centers, bureaus and institutes. Many undergraduate majors are offered with about 1,200 freshmen and sophomores taking part in the honors program. This programs offer nearly 100 honors courses per semester within which students no more than 25 per class are enrolled<sup>3,4</sup>.

### **Admission**

The Department of Civil Engineering at Maharaja Sayajirao University of Baroda admits no more than 90 students per year. Eligible students require a minimum of 12 grade secondary school with science stream and should have passed 12 Gujarat Higher Secondary Education Board (GHSEB) exams or equivalent exams. Admission is granted on combined result of GHSEB exams and Gujarat Common Entrance Test, also called as GUJCET. The Gujarat Higher Secondary Education Board conducts a centralized exam for the students studying in 12<sup>th</sup> grade school which tests the detail theoretical knowledge. The Gujarat Education board also conducts the GUJCAT which is objective type test called Multiple Choice Questions which test the fundamental understanding of the students. The final result includes 60 percent of GHSEB and 40 percent GUJCET and a merit list is prepared out of the final result. Students are given the choice to select their area of study and the schools with the student ranked top in the merit list being first. From past records, it is seen that students with percentage 60 above normally get admission to the civil engineering department at M.S. University.

Out of the total 90 seats 85 % is reserved for the GHSEB exams while the 10 % includes students with the equivalent other examination and rest 5 % for physically disabled students.

### **University of Florida**

Admission at University of Florida is granted taking many factors into consideration like Grade Point Average of the high School, Scholastic Aptitude Test(SAT ) and American Collegiate Test(ACT). International students are required to give the English test like TOEFL or equivalent if their first language is not English<sup>5</sup>.

But the minimum requirement for the qualification into the civil engineering program requires criteria to be fulfilled which are listed below.

- Completion of a regionally accredited or state approved high school or equivalent with at least 15 academic units. These units should include but are not limited to 3 years of Math, Three years of Natural Science with laboratories, 3 years of social science, 4 years of

English and 2 sequential years of foreign language. A minimum grade C is required for admit to University of Florida.

- For SAT a total score of 1330 is required with a minimum of 440 in either of verbal and quantitative.
- A composite score of 19 is required in the ACT with a minimum of 19 on math, 17 on English and 18 on reading.
- Applicants with the General Equivalency Diploma score are required to present secondary school records and standardized test score<sup>4</sup>.

### Bachelors of Civil Engineering at M.S.U.

The Bachelor's of Civil engineering at University requires a four years of rigorous study course work with two semesters each year. A total of 135 credit hours for theory and 124 credit hours for practical are required to achieve. Each semester consist of 5 courses which are predetermined by university Academic committee. All the courses till the final year are compulsory and predetermined except for the two electives which students elect in the final two semesters. Each of the courses has two sections: theory and practical for which the student has to pass in exams conducted at the end of each semester. The undergraduate program at M.S.U is shown in the table below<sup>6</sup>.

#### First Year – First Semester

COURSE	COURSE NUMBER	TOTAL HOURS REQD. PER WEEK		SCORE REQUIRED TO CLEAR THE COURSE	
		THEORY	PRACTICAL	THEORY (out of 100)	PRACTICAL (out of 50)
ENGINEERING DRAWING-I	ME 113	2	5	40	20
APPLIED PHYSICS-I	APH 101	3	4	40	20
FUNDAMENTALS OF CIVIL ENGINEERING	CE1101	3	4	40	20
MATERIAL SCIENCE	MET 114	3	4	40	20
APPLIED MATHEMATICS-I	AMA 111	3	1	40	20
WORK SHOP	CE 116	3	3	40	20

First Year– Second Semester:

COURSE	COURSE NUMBER	TOTAL HOURS REQD. PER WEEK		SCORE REQUIRED TO CLEAR THE COURSE	
		THEORY	PRACTICAL	THEORY (out of 100)	VIVA/ PRACTICAL (out of 50)
SURVEYING-I	CE-123	3	5	40	20
FUNDAMENTALS OF MECHANICAL ENGG	ME - 124	4	-	40	-
ADVANCED MATHEMATICS-II	AMA - 121	3	1	40	20
APPLIED MECHANICS	AM - 121	4	3	40	20
BUILDING DRAWING	CE - 125	3	4	40	20

Second Year– First Semester

COURSE	COURSE NUMBER	TOTAL HOURS REQD. PER WEEK		SCORE REQUIRED TO CLEAR THE COURSE	
		THEORY	PRACTICAL	THEORY (out of 100)	VIVA/ PRACTICAL (out of 50)
APPLIED MATHEMATICS - III	AMA - 211	3	5	40	20
FUNDAMENTALS OF MECHANICAL ENGG	ME - 124	4	-	40	-
ADVANCED MATHEMATICS-II	AMA - 121	3	1	40	20
APPLIED MECHANICS	AM - 121	4	3	40	20
BUILDING DRAWING	CE - 125	3	4	40	20

Second Year– Second Semester

COURSE	COURSE NUMBER	TOTAL HOURS REQD. PER WEEK		SCORE REQUIRED TO CLEAR THE COURSE	
		THEORY	PRACTICAL	THEORY (out of 100)	VIVA/ PRACTICAL (out of 50)
FLUID MECHANICS II	CE - 2107	3	3	40	20
SURVEYING II	CE - 2108	2	5	40	20
FUNDAMENTALS OF ELECTRICAL & ELECTRONIC ENGG	E - 2705	3	3	40	20
ELEMENTS OF IT PROGRAMMIN & NUMERICAL METHOD	AM - 224	3	3	40	20
ENGINEERING GEOLOGY	G - 225	3	3	40	20

Third Year- First Semester

COURSE	COURSE NUMBER	TOTAL HOURS REQD. PER WEEK		SCORE REQUIRED TO CLEAR THE COURSE	
		THEORY	PRACTICAL	THEORY (out of 100)	VIVA/ PRACTICAL (out of 50)
THEORY OF STRUCURES I	AMC - 311	4	4	40	20
ENGINEERING HYDROLOGY	CE - 3109	4	3	40	20
GEOTECHNICAL ENGINEERING I	AMC - 313	4	3	40	20
TRANSPORTATION ENGINEERING I	CE - 3110	4	3	40	20
CONSTRUCTION TECHNOLOGY	CE - 315	4	3	40	20

Third Year- Second Semester

COURSE	COURSE NUMBER	TOTAL HOURS REQD. PER WEEK		SCORE REQUIRED TO CLEAR THE COURSE	
		THEORY	PRACTICAL	THEORY (out of 100)	VIVA/ PRACTICAL (out of 50)
ENVIRONMENTAL ENGINEERING I	CE - 3313	3	4	40	20
ESTIMATION, VALUATION AND PROFESSIONAL PRACTICE	CE - 3214	4	2	40	20
GROUND WATER HYDRAULICS	AM - 324	3	3	40	20
STRUCTURAL DESIGN I	AM - 321	4	3	40	20
THEORY OF STRUCTURES II	AM - 322	4	3	40	20

First Semester - Final Year

COURSE	COURSE NUMBER	TOTAL HOURS REQD. PER WEEK		SCORE REQUIRED TO CLEAR THE COURSE	
		THEORY	PRACTICAL	THEORY (out of 100)	VIVA/ PRACTICAL (out of 50)
STRUCTURE DESIGN-II	AM - 411	3	3	40	20
ELECTIVE I		4	2	40	20
WATER RESOURCE ENGINEERING	CE - 4115	3	3	40	20
ENVIRONMENTAL ENGINEERING II	CE -	4	3	40	20
TRANSPORTATION ENGINEERING II	CE - 4116	4	3	40	20

Second Semester- Final Year

COURSE	COURSE NUMBER	TOTAL HOURS REQD. PER WEEK		SCORE REQUIRED TO CLEAR THE COURSE	
		THEORY	PRACTICAL	THEORY (out of 100)	VIVA/ PRACTICAL (out of 50)
GEOTECHNICAL ENGINEERING - II	AM - 423	3	3	40	20
ELECTIVE II		4	2	40	20
CONSTRUCTION PLANNING AND MANAGEMENT	CE - 4220	3	3	40	20
STRUCTURAL DESIGN III	AMC - 421	3	4	40	20
IRRIGATION ENGINEERING	CE - 422	4	3	40	20

For the elective two courses of their elected subject is to be selected. The elective courses are: Structural engineering, transportation engineering, Geotechnical engineering, Environmental engineering, Hydrology<sup>6</sup>.

**Civil Engineering at UF**

The civil engineering program at UF is a four year program which includes about three semesters a year. The students are required to acquire 63 credits of lower division and engineering fundamentals within first two years, 53 credits of required civil engineering course work and 15 credits of electives within last two years, for a total of 131 credits. The initial credits hours includes a general course work with basic concepts of the math and science like calculus, chemistry, physics, professional writing etc. it is from the fourth semester, students start the basic engineering concepts like introduction to Civil engineering, Statics etc. All students are required to pass the Fundamentals of Engineering Examinations prior to graduation <sup>6</sup>.

**Curriculum at UF**

Lower Division and Engineering Fundamentals (63 credits) are achieved in the initial semesters as follows<sup>7</sup>



Semester – 1

COURSE	COURSE NUMBER	CREDITS	MINIMUM GRADE REQUIRED TO PASS
CALCULUS I	MAC 2311	4	C
CHEMISTRY I	CHM 2045	4	C
HUMANITIES	HUM	3	D
SOCIAL SCIENCE	SOC	3	D
INTRODUCTION TO ENGINEERING	EGN 1002	1	D

Semester – 2

COURSE	COURSE NUMBER	CREDITS	MINIMUM GRADE REQUIRED TO PASS
CALCULUS II	MAC 2311	4	C
CHEMISTRY II	CHM 2045	3	C
PHYSICS I(W/LAB)	PHY 2048	4	C
PROFESSIONAL WRITING	ENC 3254	3	C

Semester – 3

COURSE	COURSE NUMBER	CREDITS	MINIMUM GRADE REQUIRED TO PASS
CALCULUS III	MAC 2313	4	C
PHYSICS II	PHY 2049	4	C
HUMANITIES	HUM	3	D
SOCIAL SCIENCE	SOC	3	D
INTRODUCTION TO CIVIL ENGINEERING	CGN 2002	1	

Semester – 4

COURSE	COURSE NUMBER	PRE-REQUISITE	CREDITS	MINIMUM GRADE REQUIRED TO PASS
DIFFERENTIAL EQUATIONS	MAP 2302	MAC 2313	3	C
STATICS	EGM 2511	PHY 2048	3	C
THERMODYNAMICS	EML 3007	MAC 2313	3	D

		CHM2045 PHY2048		
ENGINEERING STATISTICS	STA 3032	MAC 2311	3	D
HUMANITIES OR SOCIAL SCIENCE	HUM or SOC	-	3	D

Semester – 5

COURSE	COURSE NUMBER	PRE- REQUISITE	CREDITS	MINIMUM GRADE REQUIRED TO PASS
Dynamics	EGM 3400	MAC 2313, EGM 2511	2	C
Mechanics of Materials	EGM 3520	“	3	C

The students are required to take up required civil engineering courses with 53 credits in the next semesters with taking into account the pre-requisites of the courses.

General

COURSE	COURSE NUMBER	PRE- REQUISITE	CREDITS	MINIMUM GRADE REQUIRED TO PASS
COMPUTER METHODS IN CIVIL ENGINEERING	CGN 3421	-	4	C
EXPERIMENTATION	CGN 3710	PHY 2049	3	D
TECHNICAL DRAWING AND VISUALIZATION	CGN 2328	-	3	D
CE MATERIALS	CGN 3501	-	4	D
PROFESSIONAL ETHICS	EGN 4034	-	1	D
CONSTRUCTION				
CE COST ANALYSIS	CGN 4101	-	3	
METHODS OF MANAGEMENT	CCE 4204	CGN 4101	4	D
GEOTECHNICAL				
SOIL MECHANICS	CEG 4011	EGM 3520	4	D
GEOTECHNICAL ENGINEERING	CEG 4012	CEG 4011	3	D
HYDRAULICS AND WATER RESOURCES				
HYDRODYNAMICS	CWR 3201	EGM 3400 MAP 2302	4	D

HYDRAULICS	CWR 4202	CWR 3201	3	D
WATER AND WASTE WATER TREATMENT	ENV 4515C		3	D
STRUCTURES				
STRUCTURAL ANALYSIS	CES 3102	-	4	D
SOIL MECHANICS	CEG 4011	EGM 3520	4	D
TRANSPORTATION				
ROUTE GEOMETRICS	SUR 4201	-	3	D
TRANSPORTATION ENGINEERING	TTE 4004	-	3	D

### Track Courses

With the above Lower Division credits and upper civil engineering required courses students achieve total of 116 credits. For the rest 15 credit hours, students are required to select the track courses in their field interest as an elective. Students elect a minimum of 5 track courses each of 3 credits to make up 15 credit hours. The courses include: Construction Track, Geotechnical Track, Hydrology and Water Resource Track, Structures Track, Transportation Track and General Track.

### Comparison of courses

Courses offered at both the universities are almost same with some of the difference at the initial level.

At MSU, all courses have separate credits for theory and practical which students are required to achieve separately through exams for both. A total of 135 theory credits and 124 practical credits are required by a student. At UF combined credits for theory and practical are assigned. A student should acquire 131 total credits to get a Bachelors degree in civil engineering.

The first three semesters at UF offers the pre engineering courses or the courses for which a student is required to have a good understanding before entering college like chemistry, math, social science etc. While AT MSU the basics of engineering and engineering courses are taught right from the first semester with some basic science and math.

The major civil engineering courses are divided into two or three parts so that the time of the course students study is increased and more concentration on major courses can be given. The course like Structural Analysis is taught in two parts, while the reinforced design is taught for three consecutive semesters and many more courses. While at UF, all courses have almost equal credit hours.

The MSU provides a predetermined course schedule and all the students follow the predetermined order of course. At UF the students are required to acquire lower Division credits within first two years. While for the upper required civil engineering courses, students have

liberty to select the order of courses provided the pre-requisites of the courses are completed successfully.

At MSU student have two elective courses each in the final two semesters while at UF a student is required to complete a track course for the elective consisting of five courses 3 credits each. Students must achieve 15 credit hours of track course by taking at least 5 track courses.

The Practical and Laboratories at MSU are included in the course itself with a separate exams being conducted to test the theory and laboratories work independently. Though the separate credits are considered and required for the practical at MSU. While at UF the Lab and Practical are included in the course work with the same credit hours.

Students are required to do the drawings with the hand using drawing equipments while at UF all the students are required to use Auto cad and similar software's for drawings.

Both of the universities have not included any of the advanced design software's like Staad Pro, SAP, Midas etc.

### **Examination and grading system**

All the students at MSU are required to pass every semester exams which are conducted at the end of semesters by the university senate committee. There is a centralized examination system at MSU where other regional schools and colleges unite to form a board which conducts the common examination for the students of the schools and colleges. In order to prevent the leaking of the exam papers the exam papers are selected by the senate members, one day before the exam, from the database of papers which are prepared by faculties of different schools. The students of all the united schools are tested on the common question paper. Students are required to pass the exam of every course with the minimum requirement of 40 marks in the theory exam and 20 marks in the practical exams. The practical exams consist of the term work done throughout the semester, attendance and behavior in the classes and finally the practical and viva exam conducted. Many times the answer sheets are graded by the faculties of different schools. The final result includes the percentage of marks scored and class is given instead of grades.

40-50 - pass class

50-60- Second class

60-66- First class

66 & above- Distinction

At UF the students are tested by the faculties. There is no centralized examination. The faculties conduct the test and quiz as per their requirement and finally grades are given at the end of the semester. From the given grades final GPA (grade point average is calculated).

GRADE VALUES FOR CONVERSION									
Letter grade	A	B+	B	C+	C	D+	D	E	Below E
Grade point	4	3.5	3.0	2.5	2.0	1.5	1	0	0

The GPA is calculated as follows <sup>8</sup>

- The number of credit hours is to be multiplied by grade value for total grade points.
- Divide the total number of grade points by the number of hours carried. (Exclude S-U Option hours.)
- A minimum of 2.0 on GPA is required for every student.

## Conclusion

Here in the paper, by comparing the curriculum of civil engineering program at UF and at MSU, it is seen that though the means and methods of imparting the education is a bit different in both the university, the final goal to produce a talented, skilful civil engineer still remains the same. There are some difference in the course curriculum and examination and grading system. Since all the Indian educational institutions follow the British system of education the percentage and class system exist instead of the GPA. The credit hour required to achieve at MSU are much more that required at UF, making the civil engineering course at MSU a bit rigorous and time consuming. But at the end both the universities require at least four years to complete the program. Since the pros and cons are two sides of a coin, both the systems of education have some pros and cons which can be looked upon and taken care of by accessing and comparing points covered in this paper.

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