



COURSE ADVISING & PLANNING FOR ELECTRICAL ENGINEERING DEPARTMENT

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Abstract

Student course registration is an important as well as a trivial process and may encounter unnecessary graduation delays. United Arab Emirates University (UAEU) is one such institution where students have faced problems depending on number of factors which may include; a lack of a proper advising system, understanding and experience of Advisers, students' ability to seek good advice, etc. Students not advised fittingly may suffer with lose time in selecting unnecessary and wrong courses. Students usually suffer with problems which may include: course selection with time conflicts, missed out on specific courses for appropriate semesters, selecting department electives bypassing track restrictions, selecting too many or less courses, etc. A Student Auto Advising System (SAAS) is devised to guide students in selecting appropriate courses suitable to register online with the University Registration System. SAAS is developed using JAVA computer programming language. The outcome of the course selection is stored (semester-wise) to show a complete typical plan.

Key Words: Advising, course planning, software package, JAVA.

INTRODUCTION

The purpose of the registration process at an academic institution is commonly to determine which students will be taking what courses within the university education system, and for the administration to keep its records up-to-date. From the students' point of view, the registration process enables them to acquire the necessary authorized membership of the University and to enable them to obtain their legal & authorized benefits and privileges. Typically, when students register for particular courses, or modules, then this registration information is collected by members of the teaching staff and administration to construct class lists, and offer other academic activities, etc.

The devised Student Auto Advising System at the Faculty of Engineering, United Arab Emirates University, help and guide students in selecting appropriate courses suitable to register with the online University Registration System. Students need to consult their Academic Advisers before the start of registration period but this consultation is commonly plagued with delays or a complete miss out with either Adviser too busy or student too lazy to seek advice. The registration system ascertains an academic hold on the online course selection but this hold is automatically released on the second day of registration.

Most of these lose out students experience typical problems which may include: courses registered without completing prerequisites (this problem is almost resolved with the recent improvements to the banner system), course selection with time conflicts, missed out on specific courses which may be only offered for alternate semesters, selecting department electives bypassing track requirements and restrictions, selection of



free electives restricted for specific colleges, selecting too many courses in a specific semester whereas this selection is based on academic warnings and low grade point averages, or too less courses which again is based on minimum credit hour requirements and grade point averages, etc.

Students in some of these categories suffer with problems such as class expulsion after two or three weeks of the start because of prerequisites requirement, delay graduation because of unnecessary additional taken courses, drop a complete semester because of minimum number of courses requirement, etc. The SAAS is devised to counter such miss out or lost students to solve their advising and registration problems. The advising system helps and guide students in selecting the precise and appropriate courses suitable for online registration.

The paper describes complete operation of the advising package SAAS which includes prioritized course selection, course hierarchies, graphical charts, restrictions, and filing of the complete course plan, etc. Students can run the advising program through the electrical engineering department computer laboratories and create a typical course selection plan for all the remaining semesters until graduation. The outcome is in the form of semester-wise course selection stored in a file to show a complete typical plan.

The system is currently being used in the Electrical Engineering Department on a trial basis and modifications are under process to suit the department needs. Once the testing phase is complete, then the advising program will be implemented in all departments of the Faculty. Work is also in progress to convert the advising JAVA application program into a JAVA applet. This completed applet will be mounted on the Faculty web server for students to access the advising system online.

COURSE REGISTRATION

Before early nineties, at most of the academic institutions throughout the world, the registration process used to involve student registrations at a single place, where most of the registration related activities were to be performed after the requisite form was filled and processed by the concerned department. This (centralized) single point activity used to generate many concerns for queues, fee payments, query handling and other related issues.

In mid nineties, majority of the well known academic institutions throughout the world started to address this perspective of registration from many different angles including student advising, student course registration, class scheduling, administrative purposes, etc. Obviously, the objective seemed to produce a highly available application that required working in a distributed environment.

Beginning nineties, institutions throughout the world have seen a rapid expansion of tertiary education. As twenty first century approached, this trend increased nearly doubled. This rapid expansion has an indirect effect on the institution's enrolment. The average age of prospective students has increased as well as the number of students. As the demand is stabilized so is a need to streamline the registration process that maximizes the allocation of course places and increases the number of registered students.

Additionally, the institutions, in general, have progressed to offer programs that are specialized as well as multidisciplinary. This variety of programs has introduced time conflicts vis-à-vis chosen courses. The required registration system(s) are to be developed to provide on-line real time registration for students and enable students to maximize their opportunities in registering courses of their own interest as well as advising students in completing their degree requirements in a best possible way.

The multidisciplinary nature of modern day universities where faculties and departments can typically number as high as 10 and 50, respectively, course registration systems need to be smart enough to comprehend multiple course selections from different faculties and departments. A decent course advising system in this regard can prevent and resolve such conflicts.



The concept of computerized registration system has been to tolerate machine and network failures. It was hoped that most human errors, such as incorrectly inputting data, would be detected by the system as they occurred, but it was expected that some "off-line" data manipulation would be necessary for errors which had not been foreseen.

Therefore, the success of any attempt to computerize this activity depends on the reliability, availability and integrity of the computer systems, both software and hardware, on which the registration programs are run. Because many of the departments at any university have most likely made significant investments in computer hardware, it is logical that no specialized hardware is to be purchased and software fault-tolerance is to be used instead. The following section looks at some of similar old and recent advising systems.

COURSE ADVISING & REGISTRATION SYSTEMS

The PACE advising system is a decision model representation for course advising based on student's need to know "what to do" and "how to do it". It consisted of profiling a student's strengths and weakness, generating a personal curriculum customized to each person's needs, and producing a schedule for the courses chosen (Gunadhi, Lim, & Yeong, 1995).

The advising software at the Electrical Engineering, Texas Tech University featured a graphical user interface, that allowed students to request only courses for which they have appropriate prerequisites, co-requisites, and standing (Hagler, 1995). Similar work has been investigated by Laghari, Memon, & Habib ur Rehman (2005) on an old and phased out curriculum.

A Student Advising Software (SAS) is developed using JAVA computer programming language. It is a manual procedure which helps and guide students in selecting appropriate courses suitable for online registration with the Banner University Registration System (Laghari & Khuwaja, 2012). The academics at the Florida Atlantic University developed a similar web-based advising system that supplemented the conventional advising process (Marques, Ding, & Hsu, 2001).

A Bayesian Network model for planning course registration and advising by using a data mining technique is developed to predict the sequences of courses to be registered by undergraduate students whose majors are computer science or engineering (Pumpuang, Srivihok, Praneetpolgrang, & Numprasertchai, 2008).

A SASSY advising system is developed at the Armstrong Atlantic State University. The system suggests courses for an advisee based on; frequency of the course offering, balancing the course load, shortening the path length to graduation, preference of advisee and entertaining different scenarios of course loads for the entire duration of the advisee's university life (Hashemi & Blondin, 2010).

An expert system using JESS (a JAVA based rule engine and scripting environment) is developed that allows students to seek quick responses to their queries regarding their plan of study and progress in the program (Nambiar & Dutta, 2010).

Two project management tools are designed to help the students complete their degree plan sooner. The first tool provides a visualization map of course sequences, customized for each student, making advising adjustments that will optimize the time to obtain the degree under a constrained set of resources. The second tool collects information from multiple students through several semesters and can be used to identify bottlenecks in the curriculum (Gonzalez & Esparza, 2010).

The Arjuna distributed system was developed at The University of Newcastle upon Tyne, UK. Its design aims were to provide tools to assist in the construction of highly available, fault tolerant distributed applications using atomic actions. Shrivastava, Dixon, & Parrington (1991), have discussed the design and implementation of the registration system that successfully met their requirements (Shrivastava & Panzieri, 1988) & (Parrington et al., 1995).



Another development work was completed at the Wylie College IT for software architectural development of a course registration system using the specifications created for the college requirements. The Software Architecture Document provides an architectural overview of the C-Registration System. The C-Registration System was initiated by Wylie College IT to support online course registration (Johnson, 1999), (WyIT387, V1.0, Wylie College IT., 1998), (WyIT406, V2.0, 1999), & (WyIT418, V1.0, 1999).

As from one advising and registration system to another are browsed, it has been found that specification document is fundamental and key to further develop a customized university course registration. Furthermore, as programs to be offered vary from institution to institution, and at the same time universities continuously revise their curriculum as well as program requirements in order to meet market demands, the flexibility and reliability of the registration system to accommodate such changes in the program offerings has been deemed necessary for such a system to survive and evolve.

Thus, the required development work involves customized design of a network-enabled university student registration system that is capable of handling scenarios such as add/drop requests, student advising, availability of courses per term, student's registration status, enrolment summary, reports, etc.

Furthermore, the devised advising system which is under test phase in the department has shown representational efficiency and flexibility, improved performance, and ease of software development and maintenance when compared with some of the mentioned systems.

THE SAAS PACKAGE

There are nine United Arab Emirates University Faculties which accommodate approximately 12,279 students. The student share of the Faculty of Engineering (FOE) is 1854 students distributed among five departments. Students from Electrical Engineering Department (200 students) take 168 credit hours to fulfill the requirements for a B.Sc. degree in either of the two tracks of: Electrical Engineering or Communications Engineering. Typically it takes from a minimum of 11 to a maximum of 16 semesters to complete their degree requirements with an average course work of 15 to 18 credits (4 to 6 courses) per semester.

The total of the credit hours is divided into *UGRU* (University General Requirements Unit) - 42 credits, *FRU* (Faculty Requirements Unit) - 41 credits, Department Compulsory Specialization Requirements - 52 credits, Department Elective Specialization Requirements - 12 credits, Industrial Training - 15 credits, and the Graduation Projects - 6 credits.

The student automated advising software package consists of an interface as shown in Figure 1. The display consists of two text columns, student information section, several interactive buttons, and a completed credit hours text window. The first (left) text column displays all courses of the department. A typical advising session starts with the student pressing the 'New User' button shown in the lower button panel of the package. This allows the user to enter information such as the student name, ID, GPA (*Grade Point Average*), degree major, and the current date as shown in the display. Using the 'Get Selections' interactive button and by mouse click on the required all courses first text column creates an display a list of all passed and current registered courses in the second (right) text column display. Figure shows the results of a typical student input with 72 credit hours of completed course work.

After this selection procedure, the student starts the process of automated course selection by pressing the 'Auto Advising' interactive button. The automated selection procedure continues selecting courses for each next semester by pressing the 'Semester' button until all the degree requirement courses are chosen and displayed semester-wise.

Figure 2 shows the display for the first semester (Spring 2012) of course selection with six courses automatically chosen for the student. The credit hours window is also increased to 88. Subsequently, each next semester courses are displayed in the next semester column until the course selection of the last semester as shown in Figure 3 with completed credit hours equals to 168 credit hours of degree requirement. All

subsequent displays are saved in a file for the student to keep a record of advising to use later for registration purpose. Figure 4 shows the complete contents of the saved file in the Appendix.

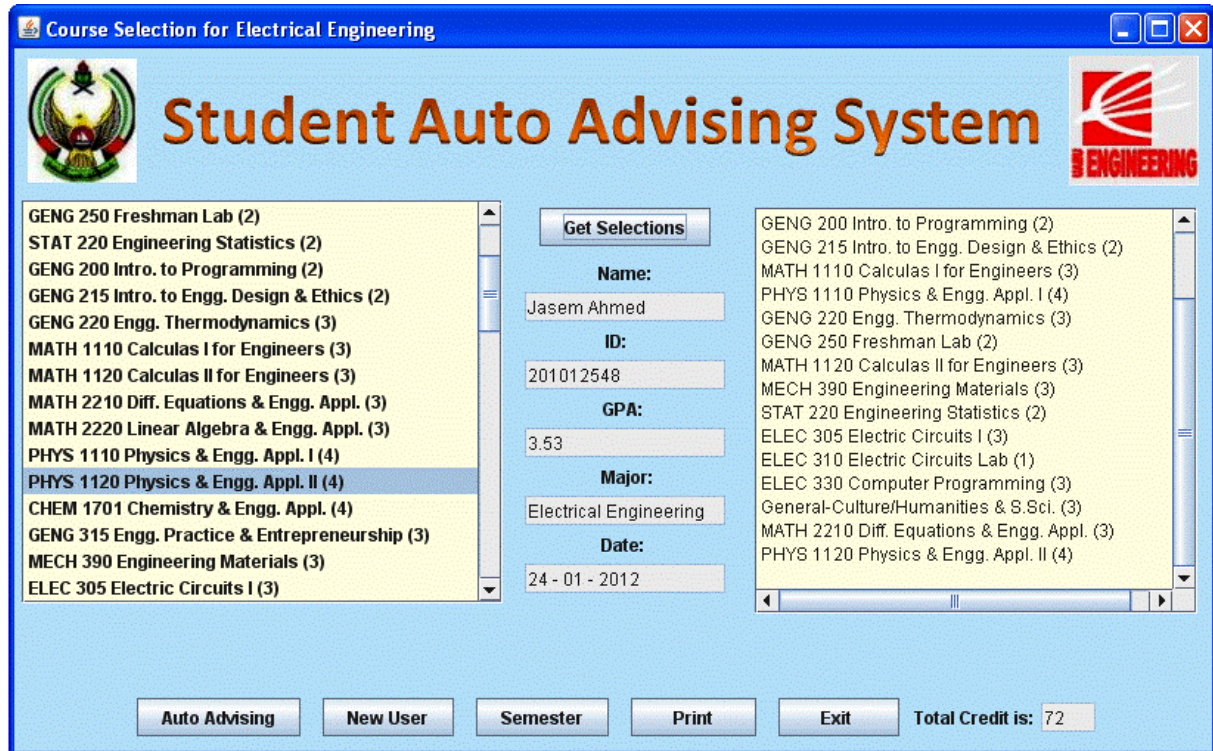


Figure 1: Interface of the SAAS package showing 72 CH of previously passed and current semester courses.

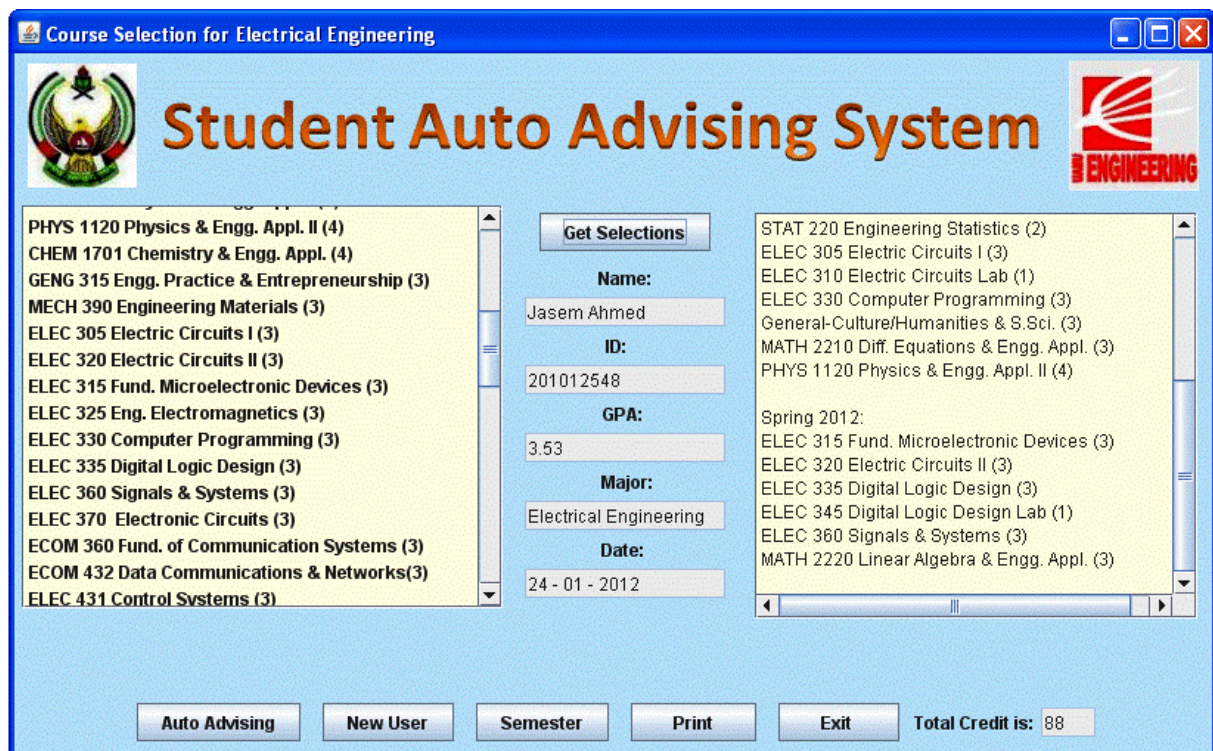


Figure 2: First interaction with the Auto Advising button showing Spring 2012 courses.

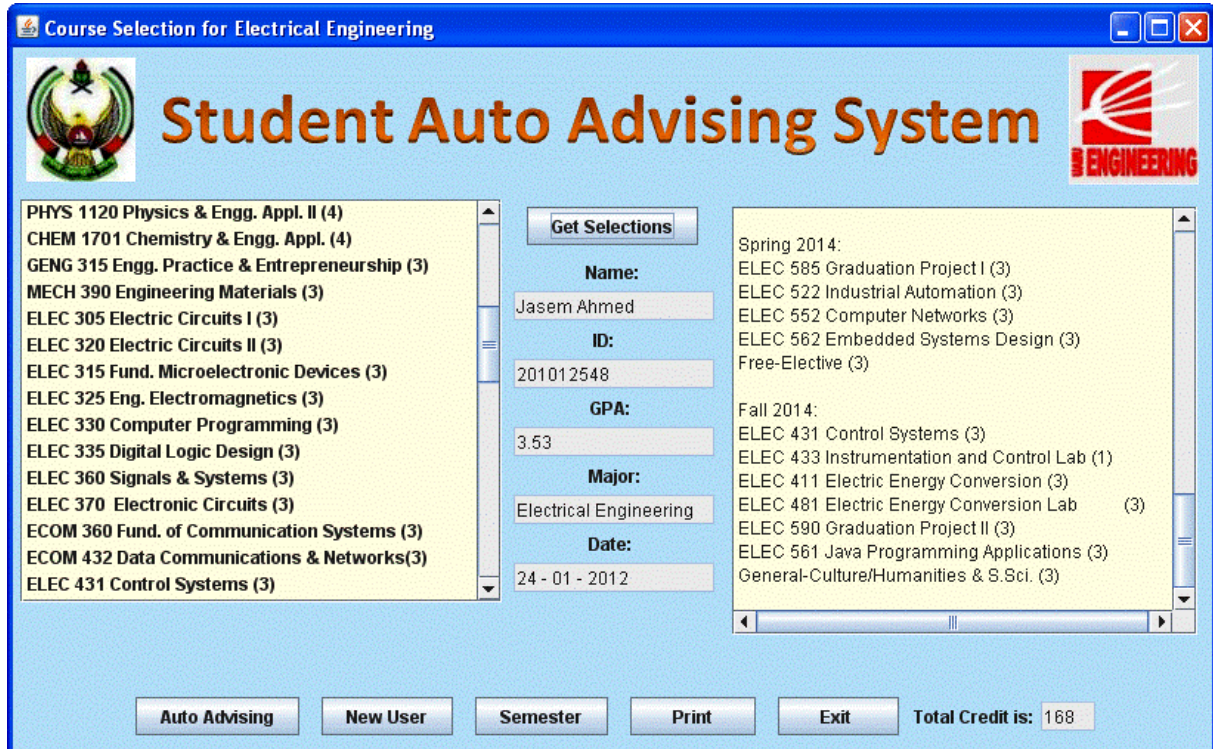


Figure 3: Completed auto course selection procedure showing the last semester of Fall 2014.

Department Electives

Some of the department core courses are offered in alternate semesters of either 1st (Fall) or 2nd (Spring). However, most of the courses are offered in both semesters. Figure 5 shows an EE course hierarchical chart with some of the offered courses distributed according to semesters shown as 1 or 2 over courses. Courses with no number are offered in both semesters. The course hierarchies are shown with arrows. Similarly, department electives are also separated to be offered in both semesters. In the auto course selection, when the system has to choose a department elective it automatically pops up an elective course list specific for the offering semester. The student is then given a choice to select an appropriate elective of interest. The elective course selection is completed with the mouse click.

Well, at the course offering time for a scheduled semester the chances are that the earlier chosen elective may not be offered because all electives are not offered at all times. Then, definitely student has to choose another department elective. Alternately, student can make a request for a particular elective to be offered.

University Courses

All engineering students take two General Culture/Humanities & Social Science courses and two Free Electives selected from other Faculties. There is long list of offered courses in both the disciplines. Similar to the department electives all university courses are not offered in both semesters. Therefore the system automatically selects courses with generic names such as Free-Elective 1, etc. At the time of registration, student chooses courses of interest from a pool of university offered courses.

Knowledge Area

As mentioned previously that appropriate courses are offered in specific semesters. In a typical advising session, student inputs all previously passed or currently registered courses. Dependant on the entry date the system finds the next semester to be either 1st or 2nd. Then based on student entered course data, the system

selects only specific courses of the next advising semester whose prerequisite has been already been passed or taken by the student. For example, if for next semester 20 department courses are offered, then only a shorter list of courses is consider by the system to choose from. Therefore, the systems' decision to choose specific courses is not based on all courses offered in the semester but on a shorter list.

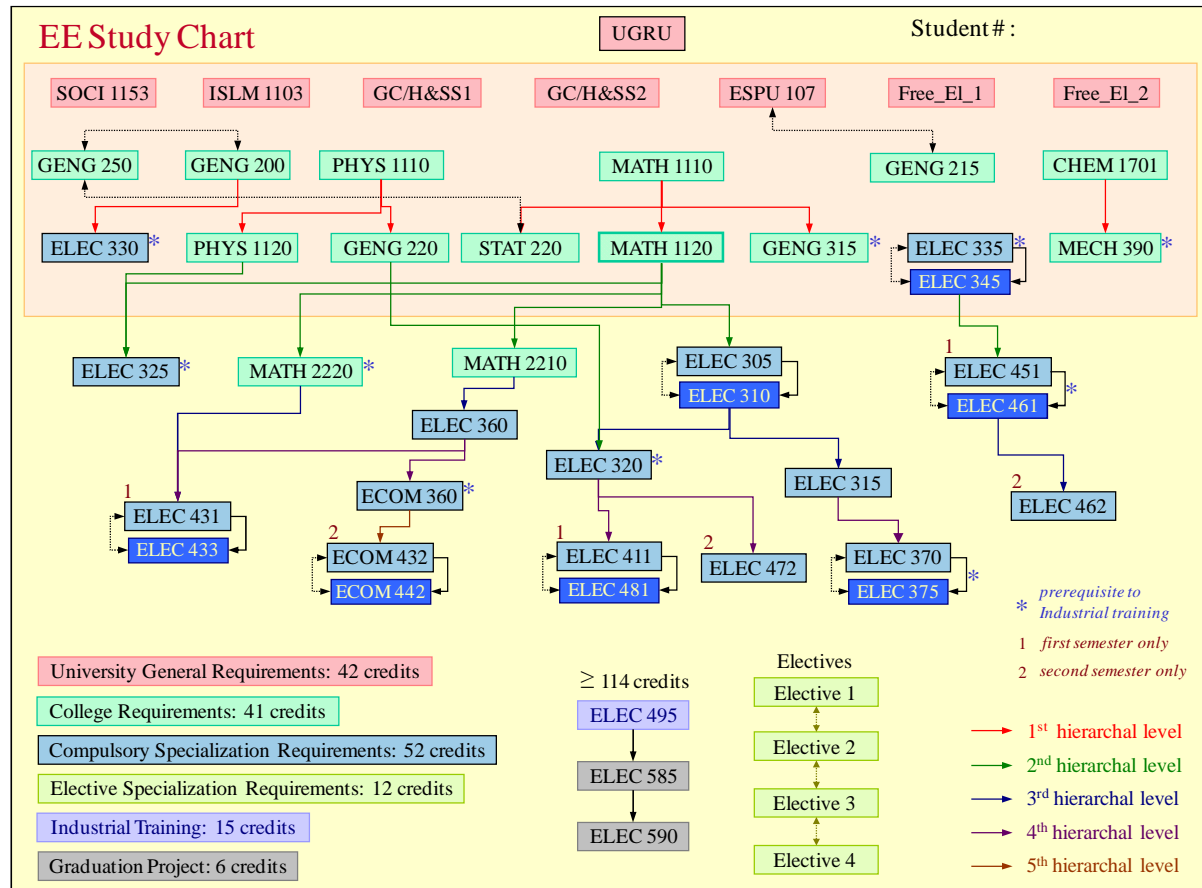


Figure 5: Study chart with course hierarchical levels.

The system also calculates the total number of credit hours required after the previously passed and current semester courses to find out the total number of semesters needed and also the number of courses for each semester. For example, from Figure 1, the remaining # of credit hours is $168 - 72 = 95$. Removing another 15 (industrial training semester) leaves 81 credit hours. With the typical student average of 15 to 18 credit hours of course work, the student needs a total of six semesters including industrial training as shown in Figure 4. Students with higher GPAs are given a choice for a normal or fast track of degree completion. More than six courses per semester may be chosen for a fast track degree.

The SAAS decision to choose a specific course from a pool of offered and appropriate courses is based on the knowledge area built around each course. Figure 6 shows the *MATH 2210* Faculty Requirements Unit course with its associated knowledge area. All courses are bracket together with additional fields; the first value of 3 in the field indicates that the course has three forward hierarchical levels; the second indicates the number of course(s) opening in the next semester which is dependent on this particular course; the third indicates that there are a total of six courses in the following semesters dependent on this course; and the last value of the field indicates the number of department electives dependent on this course.

The associated course fields are prioritized in the advising system with the first field having the highest priority. The advising selection procedure performs a field-wise comparison of all suitable courses. All courses with a higher first field value are chosen first. If there are courses still remaining to fit in a semester and the first field

value is same for many such courses then second field is considered. Again the selection is the choice of which course opens more of the next semester courses. If still more courses for an individual semester is required then the third field is considered and so on.

There is also a chance that there may be two or more choices of same level courses for a specific semester then the student is allowed to choose between the two or more courses of interest.

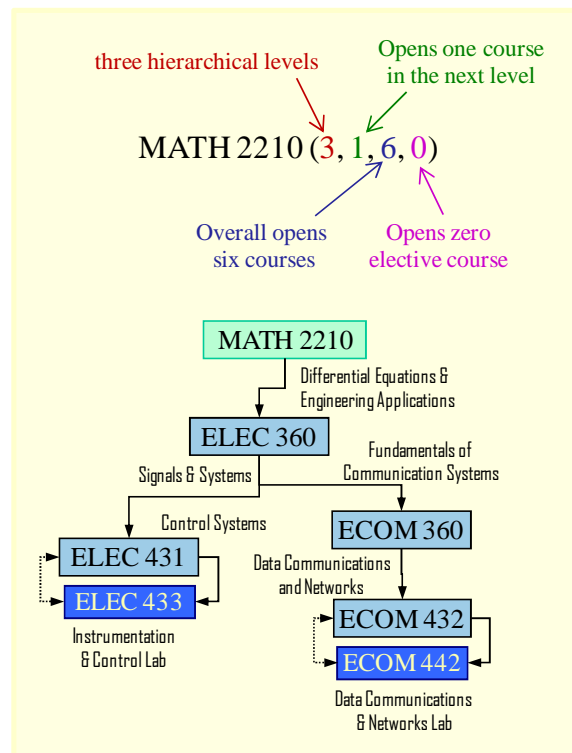


Figure 6: Systems' knowledge area with additional fields.

CONCLUSION

Student course registration is an important as well as a trivial process and may encounter unnecessary graduation delays. United Arab Emirates University is one such institution where students have faced problems with advising and course registration. A Student Auto Advising System has been devised to guide students in selecting appropriate courses suitable to register online with the University Registration System. SAAS is developed using JAVA computer programming language. The outcome of the course selection is stored (semester-wise) to show a complete typical plan. Future work will concentrate on integrating the automatic procedure with a manual procedure investigated earlier.

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APPENDIX

NAME: Jasem Ahmed
ID #: 201012548
MAJOR: Electrical Engineering
GPA: 3.53
Date: 24-01-2012

Total of past and current courses:
UGRU, ESPU 107, SOCI 1153, CHEM 1701, GENG 200, GENG 215, MATH 1110, PHYS 1110, GENG 220, GENG 250, MATH 1120,
MECH 390, STAT 220, ELEC 305, ELEC 310, ELEC 330, General-Culture/Humanities & S. Sci., MATH 2210, PHYS 1120.
Total Credit is: 72

Spring 2012:
ELEC 315 Fund. Microelectronic Devices (3)
ELEC 320 Electric Circuits II (3)
ELEC 335 Digital Logic Design (3)
ELEC 345 Digital Logic Design Lab (1)
ELEC 360 Signals & Systems (3)
MATH 2220 Linear Algebra & Engg. Appl.(3)
Total Credit is: 88

Fall 2012:
ELEC 325 Eng. Electromagnetics (3)
ECOM 360 Fund. of Communication Systems (3)
ELEC 370 Electronic Circuits (3)
ELEC 375 Electronic Circuits Lab (1)
ELEC 451 Microprocessors (3)
ELEC 461 Microprocessors Lab (1)
GENG 315 Engg. Practice & Entrepreneurship (3)
Total Credit is: 105

Spring 2013:
ECOM 432 Data Communications & Networks (3)
ECOM 442 Data Communications & Networks Lab (1)
ELEC 462 Computer Architecture and Organization (3)
ELEC 472 Power Systems (3)
ISLM 1103 Islamic Thought (3)
Free-Elective (3)
Total Credit is: 121

Fall 2013:
ELEC 495 Industrial Training (15)
Total Credit is: 136

Spring 2014:
ELEC 585 Graduation Project I (3)
ELEC 522 Industrial Automation (3)
ELEC 552 Computer Networks (3)
ELEC 562 Embedded Systems Design (3)
Free-Elective (3)
Total Credit is: 151

Fall 2014:
ELEC 431 Control Systems (3)
ELEC 433 Instrumentation and Control Lab (1)
ELEC 411 Electric Energy Conversion (3)
ELEC 481 Electric Energy Conversion Lab (1)
ELEC 590 Graduation Project II (3)
ELEC 561 Java Programming Applications (3)
Culture/Humanities & S. Sci.(3)
Total Credit is: 168