



دليل  
كلية الهندسة  
2020

قسم هندسة الحاسب

**Computer Engineering Department**

The 1<sup>st</sup>: List of General courses

أولاً:- قوائم مسميات المقررات الدراسية للمرحلة العامة :-

## Humanities courses

## العلوم الإنسانية

| Course No.    | Course name                 | Pre request | Credits | اسم المقرر            | رقم المقرر |
|---------------|-----------------------------|-------------|---------|-----------------------|------------|
|               |                             | المتطلبات   | الوحدات |                       |            |
| GH141         | English I                   | Nil         | 3       | اللغة الإنجليزية 1    | ع 141      |
| GH142         | English II                  | GH141       | 3       | اللغة الإنجليزية 2    | ع 142      |
| GH150         | Arabic I                    | Nil         | 2       | اللغة العربية 1       | ع 150      |
| GH151         | Arabic II                   | GH150       | 1       | اللغة العربية 2       | ع 151      |
| GH152         | Technical Writing in Arabic | GH151       | 1       | كتابة التقارير الفنية | ع 152      |
| Total Credits |                             |             | 10      | إجمالي عدد الوحدات    |            |

## General Science Course

## العلوم الأساسية العامة

| Course No.    | Course name              | Pre request | Credits | اسم المقرر          | رقم المقرر |
|---------------|--------------------------|-------------|---------|---------------------|------------|
|               |                          | المتطلبات   | الوحدات |                     |            |
| GS101         | Mathematics I            | Nil         | 3       | الرياضيات 1         | ع 101      |
| GS102         | Mathematics II           | GS101       | 4       | الرياضيات 2         | ع 102      |
| GS111         | Physics I                | Nil         | 3       | الفيزياء 1          | ع 111      |
| GS112         | Physics II               | GS111       | 3       | الفيزياء 2          | ع 112      |
| GS112L        | Physics Lab              | GS111       | 1       | فيزياء معمل         | ع 112 م    |
| GS115         | Chemistry                | Nil         | 3       | الكيمياء العامة     | ع 115      |
| GS115L        | Chemistry Lab            | Nil         | 1       | الكيمياء معمل       | ع 115 م    |
| GS203         | Mathematics III          | GS102       | 3       | الرياضيات 3         | ع 203      |
| GS204         | Mathematics IV           | GS102       | 3       | الرياضيات 4         | ع 204      |
| GS206         | Probability & Statistics | Nil         | 3       | الإحصاء والاحتمالات | ع 206      |
| M305          | Advanced Mathematics     |             | 3       | رياضيات متقدمة      | ر 305      |
| PH317         | Modern Physics           |             | 3       | الفيزياء المتقدمة   | ف 317      |
| Total Credits |                          |             | 33      | إجمالي عدد الوحدات  |            |



## General Engineering Courses

## العلوم الهندسية العامة

| Course No.    | Course name              | Pre request       | Credits | اسم المقرر         | رقم المقرر |
|---------------|--------------------------|-------------------|---------|--------------------|------------|
|               |                          | المتطلبات         | الوحدات |                    |            |
| GE121         | Engineering Mechanics I  | Nil               | 3       | ميكانيكا هندسية 1  | هـ ع 121   |
| GE125         | Engineering Graphics     | Nil               | 2       | الهندسة الوصفية    | هـ ع 125   |
| GE127         | Engineering Drawing      | Nil               | 2       | الرسم الهندسي      | هـ ع 127   |
| GE129         | Workshop Technology      | Nil               | 2       | تقنية الورش        | هـ ع 129   |
| GE129 L       | Workshop Technology Lab  | Nil               | 1       | معمل تقنية الورش   | هـ ع 129 م |
| GE133         | Properties of Materials  | GS101 GS111 GS115 | 3       | خواص المواد        | هـ ع 133   |
| GE222         | Engineering Mechanics II | GE121             | 3       | ميكانيكا هندسية 2  | هـ ع 222   |
| Total Credits |                          |                   | 16      | إجمالي عدد الوحدات |            |

ثانياً :- قائمة مسميات المقررات الدراسية الملزمة لجميع طلبة قسم هندسة الحاسب .

## The 2nd: List of Departmental Compulsory Courses

| Course No. | Course name                    | Pre request   | Credits | اسم المقرر                | رقم المقرر  |
|------------|--------------------------------|---------------|---------|---------------------------|-------------|
|            |                                | المتطلبات     | الوحدات |                           |             |
| EC201      | Systems & Circuits I           | GS102 + GS112 | 3       | دوائر ومنظومات كهربائية 1 | هـ حس 201   |
| EC202      | Systems & Circuits II          | EC201         | 3       | دوائر ومنظومات كهربائية 2 | هـ حس 202   |
| EC251      | Intro. to Computer Programming | GS102 + GS112 | 3       | مقدمة برمجة الحاسوب       | هـ حس 251   |
| EC252      | Object Oriented Programming    | EC251         | 3       | البرمجة الكائنية التوجه   | هـ حس 252   |
| EC301      | Linear Systems                 | EC310 + GS204 | 3       | أنظمة خطية                | هـ حس 301   |
| EC310      | Electronic Material & Devices  | EC201         | 3       | مواد ونبائط كهربائية      | هـ حس 310   |
| EC312      | Electronic Circuits I          | EC310 + EC201 | 3       | دوائر إلكترونية 1         | هـ حس 312   |
| EC312L     | Electronic Circuits I Lab.     | EC310         | 1       | معمل دوائر إلكترونية 1    | هـ حس 312 م |



| Course No. | Course name                          | Pre request          | Credits | اسم المقرر                             | رقم المقرر |
|------------|--------------------------------------|----------------------|---------|----------------------------------------|------------|
|            |                                      | المتطلبات            | الوحدات |                                        |            |
| EC313      | Electronic Circuits II.              | EC312 + EC312L       | 3       | دوائر إلكترونية 2                      | ه حس 313   |
| EC313L     | Electronic Circuits II Lab.          | EC312 + EC312L       | 1       | معمل دوائر إلكترونية 2                 | ه حس 313 م |
| EC331      | Intro. To Communication Systems      | EC301 + GS206        | 3       | مقدمة منظومات الاتصالات                | ه حس 331   |
| EC331L     | Intro. To Communication Systems Lab. | EC301 + GS206        | 1       | معمل مقدمة منظومات الاتصالات           | ه حس 331 م |
| EC351      | Intro. to Computer Systems           | EC251+381            | 3       | مقدمة للأنظمة الحاسوبية                | ه حس 351   |
| EC352      | Data Structures & Algorithms I       | EC252                | 3       | بنية البيانات والخوارزميات             | ه حس 352   |
| EC372      | Intro. to Numerical Analysis         | EC251 + GS204        | 3       | مقدمة التحليل العددي                   | ه حس 372   |
| EC381      | Digital Systems I                    | EC201                | 3       | منظومات رقمية I                        | ه حس 381   |
| EC381L     | Digital Systems I Lab.               | EC201                | 1       | معمل منظومات رقمية                     | ه حس 381 م |
| EC383      | Digital Systems II                   | EC381 + EC381L       | 3       | منظومات رقمية II                       | ه حس 383   |
| EC383L     | Digital Systems II Lab.              | EC381 + EC381L       | 1       | معمل منظومات رقمية                     | ه حس 383 م |
| EC433      | Computer Networks                    | EC331 + EC331L       | 3       | شبكات حاسوبية                          | ه حس 433   |
| EC433L     | Computer Networks Lab.               | EC331 + EC331L       | 1       | معمل شبكات حاسوبية                     | ه حس 433 م |
| EC441      | Data Acquisition & Control           | EC313 + EC202+EC313L | 3       | استحصال البيانات للقياس والتحكم        | ه حس 441   |
| EC441L     | Data Acquisition & Control I Lab.    | EC313 + EC202+EC313L | 1       | معمل استحصال البيانات للقياس والتحكم 1 | ه حس 441 م |
| EC446      | Analog Control Systems               | EC313 + EC301+EC313L | 3       | منظومات التحكم التماثلي                | ه حس 446   |
| EC446L     | Analog Control Systems Lab.          | EC313 + EC301+EC313L | 1       | معمل منظومات التحكم التماثلي           | ه حس 446 م |
| EC448      | Digital Signal Processing            | EC301 + EC372        | 3       | معالجة الإشارات الرقمية                | ه حس 448   |



|               |                                      |                         |    |                                  |            |
|---------------|--------------------------------------|-------------------------|----|----------------------------------|------------|
| EC451         | Operating Systems                    | EC352+EC383+<br>EC351   | 3  | نظم التشغيل                      | ه حس 451   |
| EC482         | Microprocessor<br>Systems            | EC351 +<br>EC383+EC383L | 3  | المعالجات الدقيقة                | ه حس 482   |
| EC482L        | Microprocessor<br>Systems Lab.       | EC351 +<br>EC383+EC383L | 1  | معمل المعالجات<br>الدقيقة        | ه حس 482 م |
| EC483         | Microprocessor &<br>Embedded systems | EC482 + EC451<br>EC482L | 3  | نظم الحواسيب<br>الصغيرة والدقيقة | ه حس 483   |
| EC499         | B.Sc. Project                        | EC441 + EC483           | 4  | المشروع                          | ه حس 499   |
| Total Credits |                                      |                         | 76 | إجمالي عدد الوحدات               |            |

## قائمة مسميات المقررات الاختيارية لقسم هندسة الحاسب

يلزم الطالب بإختيار عدد 4 مقررات دراسية من القائمة أدناه بواقع 12 وحدة دراسية

| Course<br>No. | Course name                                  | Pre request   | Credits<br>الوحدات | اسم المقرر                          | رقم المقرر |
|---------------|----------------------------------------------|---------------|--------------------|-------------------------------------|------------|
|               |                                              | المتطلبات     |                    |                                     |            |
| EC501         | Adaptive Signal<br>Processing                | EC448 + EC547 | 3                  | المعالجة التكيفية<br>للإشارات       | ه حس 501   |
| EC511         | Solid State<br>Electronics                   | EC310         | 3                  | الالكترونيات في<br>الحالة الجامدة   | ه حس 511   |
| EC512         | Semiconductor<br>Device<br>Manufacturing     | EC310         | 3                  | تصنيع أشباه<br>الموصلات             | ه حس 512   |
| EC513         | Optoelectronic<br>Devices                    | EC313         | 3                  | الاجهزة الالكترونية<br>الضوئية      | ه حس 513   |
| EC514         | Digital Electronics                          | EC313 + EC381 | 3                  | الالكترونيات<br>الرقمية             | ه حس 514   |
| EC520         | Internet Security                            | EC433         | 3                  | حماية شبكة<br>المعلومات             | ه حس 520   |
| EC522         | TCP/IP Protocol<br>Design and<br>Programming | EC433         | 3                  | تصميم و برمجة<br>بروتوكول<br>TCP/IP | ه حس 522   |
| EC523         | Distributed<br>Computing                     | EC433,EC451   | 3                  | الحوسبة الموزعة                     | ه حس 523   |
| EC530         | High speed<br>Networks                       | EC433         | 3                  | شبكات عالية<br>السرعة               | ه حس 530   |
| EC531         | Data<br>Communications                       | EC331,EC482   | 3                  | اتصالات البيانات                    | ه حس 531   |
| EC532         | Optical Fiber                                | EC331         | 3                  | اتصالات الالياف                     | ه حس 532   |



|       |                                             |                |   |                                      |           |
|-------|---------------------------------------------|----------------|---|--------------------------------------|-----------|
|       | Communications                              |                |   | البصرية                              |           |
| EC534 | Satellite Communications                    | EC331          | 3 | اتصالات عبر القمر الصناعي            | هـ حس 534 |
| EC537 | Digital Communications                      | EC331          | 3 | الاتصالات الرقمية                    | هـ حس 537 |
| EC539 | Mobile Cellular and Wireless Communications | EC433          | 3 | الاتصالات اللاسلكية الخلوية المتنقلة | هـ حس 539 |
| EC540 | System Identification                       | EC446          | 3 | تحديد النظام                         | هـ حس 540 |
| EC542 | Data Acquisition & Control                  | EC441          | 3 | استحصال البيانات للقياس والتحكم      | هـ حس 542 |
| EC543 | Identification and Adaptive Control         | EC547          | 3 | التحديد والتحكم التكيفي              | هـ حس 543 |
| EC544 | Coding Theory                               | EC331, EC381   | 3 | نظرية التشفير                        | هـ حس 544 |
| EC545 | Fuzzy Engineering                           | EC446          | 3 | هندسة غامضة                          | هـ حس 545 |
| EC546 | Nonlinear Control                           | EC446          | 3 | التحكم غير الخطي                     | هـ حس 546 |
| EC547 | Digital Control                             | EC446          | 3 | التحكم الرقمي                        | هـ حس 547 |
| EC550 | Topics in S/W Engineering                   | EC451, EC482   | 3 | مواضيع في هندسة البرمجيات            | هـ حس 550 |
| EC552 | Data Structure & Algorithms II              | EC352, EC451   | 3 | هيكلية البيانات والخوارزميات         | هـ حس 552 |
| EC554 | Program Specification & Verification        | EC352 + EC451  | 3 | المواصفات والتحقق للبرمجيات          | هـ حس 554 |
| EC555 | Software Engineering                        | EC451          | 3 | هندسة برمجيات                        | هـ حس 555 |
| EC556 | Database System Design                      | EC352, EC451   | 3 | تصميم أنظمة البيانات                 | هـ حس 556 |
| EC557 | Pattern Recognition                         | EC 301 + GS206 | 3 | تمييز الأنماط                        | هـ حس 557 |
| EC558 | Artificial Intelligence                     | EC451 + EC482  | 3 | الذكاء الاصطناعي                     | هـ حس 558 |
| EC559 | Advance Programming using JAVA              | EC352          | 3 | البرمجة المتقدمة باستخدام جافا       | هـ حس 559 |
| EC560 | Neural Networks                             | EC351 + EC446  | 3 | الشبكات العصبية                      | هـ حس 560 |
| EC561 | Distributed Real Time Control Sys           | EC451, EC433   | 3 | توزيع أنظمة التحكم في الوقت الحقيقي  | هـ حس 561 |



|       |                                         |               |   |                                        |           |
|-------|-----------------------------------------|---------------|---|----------------------------------------|-----------|
| EC565 | Computer Based Instrument               | EC441         | 3 | أداة حاسوبية                           | 565 هـ حس |
| EC572 | Numerical Analysis II                   | EC372         | 3 | التحليل العددي 2                       | 572 هـ حس |
| EC573 | Probabilistic Models                    | EC351 + GS206 | 3 | نماذج احتمالية                         | 573 هـ حس |
| EC574 | Optimization Techniques                 | EC372         | 3 | تقنيات الاستمثال                       | 574 هـ حس |
| EC575 | Modeling and Simulation                 | EC451         | 3 | نمذجة ومحاكاة                          | 575 هـ حس |
| EC577 | Robotics                                | EC446         | 3 | الانسان الآلي                          | 577 هـ حس |
| EC578 | Soft Computing & Applications           | EC451+EC482   | 3 | الحوسبة اللينة وتطبيقاتها              | 578 هـ حس |
| EC579 | Computer Systems Performance Evaluation | EC451 + EC482 | 3 | تقييم أداء أنظمة الحاسوب               | 579 هـ حس |
| EC580 | Special Topics in Digital Systems       | EC482 + EC451 | 3 | مواضيع خاصة في النظم الرقمية           | 580 هـ حس |
| EC582 | FPGA Design for Embedded Sys            | EC482         | 3 | تصميم FPGA للأنظمة المدمجة             | 582 هـ حس |
| EC583 | VLSI Systems                            | EC483         | 3 | أنظمة VLSI                             | 583 هـ حس |
| EC584 | Computer Memory and I/O                 | EC482         | 3 | ذاكرة الحاسوب وبوابات الإدخال والإخراج | 584 هـ حس |
| EC585 | Computer Architecture                   | EC483 + EC451 | 3 | بنية الحاسوب                           | 585 هـ حس |
| EC586 | Computer Graphics                       | EC372 + EC352 | 3 | الرسومات الحاسوبية                     | 586 هـ حس |
| EC587 | Digital System Testing & Simulations    | EC483         | 3 | اختبار و محاكاة نظم رقمية              | 587 هـ حس |
| EC588 | Switching Theory                        | EC482         | 3 | نظرية دوائر الاستبدال                  | 588 هـ حس |
| EC589 | Computer Aided Design                   | EC313 + EC372 | 3 | حوسبة التصميم                          | 589 هـ حس |
| EC590 | Computer & Society                      | EC451 + EC482 | 3 | المجتمع والحاسوب                       | 590 هـ حس |
| EC591 | Parallel Processing                     | EC451 + EC482 | 3 | المعالجة المتوازية                     | 591 هـ حس |
| EC593 | Digital Image Processing                | EC301         | 3 | معالجة الصور الرقمية                   | 593 هـ حس |



## ملخص عدد الوحدات المطلوبة للتخرج لجميع لطلبة القسم

| القسم          | الشعبة           | العلوم الإنسانية |                                             | العلوم الأساسية العامة |                                             | العلوم الهندسية العامة |                                             | المقررات التخصصية المازمة لجميع طلبة القسم |                                             | المقررات التخصصية الاختيارية لطلبة القسم |                                             | الإجمالي |
|----------------|------------------|------------------|---------------------------------------------|------------------------|---------------------------------------------|------------------------|---------------------------------------------|--------------------------------------------|---------------------------------------------|------------------------------------------|---------------------------------------------|----------|
|                |                  | عدد              | النسبة المئوية من إجمالي عدد الوحدات الكلية | عدد                    | النسبة المئوية من إجمالي عدد الوحدات الكلية | عدد                    | النسبة المئوية من إجمالي عدد الوحدات الكلية | عدد                                        | النسبة المئوية من إجمالي عدد الوحدات الكلية | عدد                                      | النسبة المئوية من إجمالي عدد الوحدات الكلية |          |
| الهندسة الحاسب | القسم شعبة واحدة | 10               | 6.8%                                        | 33                     | 22.4%                                       | 16                     | 10.9%                                       | 76                                         | 51.7%                                       | 12                                       | 8.2%                                        | 147      |

## المحتوى العلمي للمقررات الدراسية التخصصية بقسم هندسة الحاسب

EC 201

Systems and Circuits I

3 Credits

**Pre-requisite: GS102 and GS112**

.Basic definitions of voltage current and power.Kirchhoff's voltage and current law  
 .Resistive basic circuit analysis, Advanced circuit analysis techniques  
 .Capacitors and inductors and their voltage and current relations. And related power and energy relationship, Natural and step response of first order circuit, Natural and step response of second order circuit, .Sinusoidal steady state response  
 AC power calculations

EC 202

System and Circuits II

3 Credits

**Pre-requisite: EC 201**

Magnetic fields and circuits (Energy conversion, Magnetic fields, Magnetic circuits). Transformers (AC excitation, Transformer operation, Circuit Models, Performance). Principles of electro mechanics (Translational transducers, Rotational transducers, Moving-iron devices). Direct-current machines (DC generators, DC motors). Alternating-current machines (Alternators, Synchronous motors. Induction motors).

EC 251

Introduction to Computer Programming

3 Credits

**Pre-requisite: GS102 and GS112**

Computer organization, main hardware components. Machine language versus high level language. Number systems –representation, conversion, and operations. Arithmetic and logical operations and expressions. Basic programming



constructs using C syntax, process, decision and loops. Arrays. Subprograms and modular programming. Input and output techniques. Pointers.

|        |                             |           |
|--------|-----------------------------|-----------|
| EC 252 | Object Oriented Programming | 3 Credits |
|--------|-----------------------------|-----------|

**Pre-requisites: EC 251**

This course is an introductory course in object oriented programming. The fundamental concepts of object oriented programming will be studied. It is assumed that students will be familiar with basic programming concepts and programming logic. No prior knowledge of any particular programming language is required. Grades will be assigned based on performance on examinations and programming assignments.

|        |                |           |
|--------|----------------|-----------|
| EC 301 | Linear Systems | 3 Credits |
|--------|----------------|-----------|

**Pre-requisite: EC 310 and GS 204**

Introduction. Continuous-time systems. Laplace Transform. Fourier analysis for continuous-time systems. Discrete-time systems. z-Transform. Fourier analysis for discrete-time systems.

|        |                                  |           |
|--------|----------------------------------|-----------|
| EC 310 | Electronic Materials and Devices | 3 Credits |
|--------|----------------------------------|-----------|

**Pre-requisite: EC 201**

Electronics in solids - energy bands, carrier density, mobility, resistivity. P-N junctions -properties (Thermal-equilibrium: Built-in potential barrier, Charge density, minority carrier concentration at equilibrium, Space charge width: depletion layer widths for n-side and p-side, Electric field and Current density of pn junction at equilibrium. Reverse bias and Forward bias), Semiconductor diodes (Zener diode, LED, LASER and photodiodes), diode's applications (Rectification, clamping, clipping, voltage regulator and voltage doubler.), characteristic of BJT and FET transistors.

|        |                       |           |
|--------|-----------------------|-----------|
| EC 312 | Electronic Circuits I | 3 Credits |
|--------|-----------------------|-----------|

**Pre-requisites: EC 201 and EC 310**

BJT and FET Transistors biasing. Stability of BJT and FET transistors, single and multistage BJT and FET amplifiers. Bode plot and transfer function, Frequency-response of single and cascaded amplifiers. IC biasing



|         |                            |           |
|---------|----------------------------|-----------|
| EC 312L | Electronic Circuits I Lab. | 1 Credits |
|---------|----------------------------|-----------|

**Pre-requisite: EC 201 and EC 310**

Accompanies EC 312. Some experiments concerning EC 312.

|        |                         |           |
|--------|-------------------------|-----------|
| EC 313 | Electronics Circuits II | 3 Credits |
|--------|-------------------------|-----------|

**Pre-requisites: EC 312 and EC312L**

Feedback amplifiers and stability. Operational amplifiers; characteristics and applications. Waveform generators (oscillators; sine, square, triangle waves). Wave shaping circuits (multi-stable, stable multi-vibrators, pulse generators).

|         |                            |           |
|---------|----------------------------|-----------|
| EC 313L | Electronic Circuits II Lab | 1 Credits |
|---------|----------------------------|-----------|

**Pre-requisites: EC 312 and EC312L**

Accompanies EC 313.

|        |                                       |           |
|--------|---------------------------------------|-----------|
| EC 331 | Introduction to Communication Systems | 3 Credits |
|--------|---------------------------------------|-----------|

**Pre-requisite: EC 301 and GS 206**

Spectral analysis. Modulation. Amplitude modulation (AM). Double side band suppressed-carrier (DSB-SC). Single side band (SSB). Frequency division multiplexing (FDM). Angle modulation. Phase and frequency modulation. Pulse Amplitude Modulation (PAM). Pulse Width modulation (PWM). Pulse Position Modulation (PPM). Pulse code modulation (PCM). Multiplexing. Time division multiplexing in PCM. Delta modulation (DM).

|         |                            |           |
|---------|----------------------------|-----------|
| EC 331L | Communication Systems Lab. | 1 Credits |
|---------|----------------------------|-----------|

**Pre-requisite: EC 301 and GS 206**

Accompanies EC 331

|        |                                  |           |
|--------|----------------------------------|-----------|
| EC 351 | Introduction to Computer Systems | 3 Credits |
|--------|----------------------------------|-----------|

**Pre-requisites: EC 251 and 381**

-How are programs written in a high-level language, such as C or Java, translated into the language of the hardware, and how does the hardware execute the resulting program?

-What is the interface between the software and the hardware, and how does software instruct the hardware to perform needed functions?



- What determines the performance of a program, and how can a programmer improve the performance?
- What techniques can be used by hardware designers to improve performance?
- What techniques can be used by hardware designers to improve energy efficiency? What can the programmer do to help or hinder energy efficiency?
- What are the reasons for and the consequences of the recent switch from sequential processing to parallel processing?
- Since the first commercial computer in 1951, what great ideas did computer architects come up with that lay the foundation of modern computing?

**EC 352****Data Structures and Algorithms****3 Credits****Pre-requisite: EC 252**

Packed data structures (arrays and files. Creation and retrieval of stable sparse matrices. Internal sorts algorithms. Basic operations on sequential and random files. External sorts algorithms. Strings). Dynamic data structures (linear and nonlinear. Basic operations on stacks. Arithmetic expressions translation using stacks. Linked list, double linked lists, queues, circular lists. Basic operation and application to simulation problems. Trees. Creation and parsing (traveling) algorithms).

**EC 372****Introduction to Numerical****3 Credits****Pre-requisite: EC 251 and GS 204**

Computer arithmetic and errors. Conditioning and stability of computations. Real roots finding methods. Methods for solving linear systems: Gaussian elimination, factorization, and iterative methods. Interpolation methods. Approximation by polynomials. Numerical Differentiation and integration, as well as ordinary differential equations.

**EC 381****Digital Systems I****3 Credits****Pre-requisite: EC 201**

Binary arithmetic. Boolean algebra. Basic logic elements and their characteristics. Combinational logic functions (adders, decoders, multiplexers, etc.) and their implementation. Flip-flops, gate level realization. Asynchronous counters and registers. Introduction to ROM, RAM, and PLAs. Analysis and design of small sequential logic systems. PLDS, FPGA.

**EC 381L****Digital Systems I Lab.****1 Credits**



**Pre-requisite: EC 201**

Design, implementation and testing of combinational and sequential logic circuits using SSI and MSI logic modules (TTL & CMOS) (e.g. adders, counters, encoders, decoders, multiplexers, flip flops... etc.)

Accompanies EC 381

|        |                    |           |
|--------|--------------------|-----------|
| EC 383 | Digital Systems II | 3 Credits |
|--------|--------------------|-----------|

**Pre-requisite: EC 381 and EC381L**

Digital systems. Register Transfer Level Design. Data path and control unit. Control unit structure: hardwired, micro-programmed. ALU structure - integer & floating-point arithmetic functions. CPU structure - basic instructions control design. ALU & simple I/O systems.

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|---------|-------------------------|-----------|
| EC 383L | Digital Systems II Lab. | 1 Credits |
|---------|-------------------------|-----------|

**Pre-requisites: EC 381 and EC381L**

Design, Implementation, and Testing of Register Level Digital Systems. Emphasizing the use of MSI & LSI devices.

Accompanies EC 383

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|--------|-------------------|-----------|
| EC 433 | Computer Networks | 3 Credits |
|--------|-------------------|-----------|

**Pre-requisites: EC 331 and EC331L**

This course will provide an introduction to computer networking technologies, including architectures, protocols, and interfaces. Addressing, routing, flow control, queuing, and routing will be discussed. It covers the concepts, vocabulary, design issues, and techniques currently used in the area of computer networks. Topics include history and evolution, transmission media, interconnection topology, control methods, protocols, types of nodes, network interfaces, performance analysis, diagnosis and maintenance, taxonomy, bridges, and gateways.

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|---------|------------------------|-----------|
| EC 433L | Computer Networks Lab. | 1 Credits |
|---------|------------------------|-----------|

**Pre-requisite: EC 331 and EC331L**

Accompanies EC 433



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|--------|--------------------------------|-----------|
| EC 441 | Data Acquisition and Control I | 3 Credits |
|--------|--------------------------------|-----------|

**Pre-requisite: EC 313, EC313L and EC 202**

This course covers the organization of data acquisition channels with emphasis on characteristics of channel elements and computation of error budget. Topics includes sensors and transducers, instrumentation amplifiers, signal conditioning techniques, loading effects, considerations of bandwidth and stability, recovery of signals from noise, correlation and sampling techniques, Active and digital filters, in addition to A/D, D/A conversion methods. Also, the course highlights interference and noise, common mode rejection techniques for elimination of ground loops, screening, and guard techniques.

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| EC 441L | Data Acquisition and Control Lab. | 1 Credits |
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**Pre-requisite: EC 313, EC313L and EC 202**

Accompanies EC 441

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| EC 446 | Analog Control Systems | 3 Credits |
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**Pre-requisite: EC 313, EC313L and EC 301**

Feedback Control systems concepts, speed and position control systems. Frequency response techniques - use of Bode, inverse Nyquist. root-locus and Nichols charts. Performance criteria, errors, sensitivity, stability and time response. Compensation techniques. State-space representation, analysis and design.

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| EC 446L | Analog Control Systems Lab. | 1 Credits |
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**Pre-requisites: EC 313, EC313L and EC 301**

Accompanies EC 446

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| EC 448 | Digital Signal Processing | 3 Credits |
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**Pre-requisites: EC 301 and EC 372**

Concept of orthogonal function. Fourier series, Fourier transform. Fast Fourier transform. Analysis of discrete time systems. Frequency response, impulse response. Design of FIR filters. Window technique. Frequency sampling and



optical filters. Design of MR filters using analog techniques. Butterworth and Chebyshev filters.

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|--------|-------------------|-----------|
| EC 451 | Operating Systems | 3 Credits |
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**Pre-requisites: EC352, EC351 and EC 383**

Computer systems organization. Types and functions of operating systems. Process management, Memory management, I/O management. Case studies of typical operating systems (Unix, DOS).

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|--------|------------------------|-----------|
| EC 482 | Microprocessor Systems | 3 Credits |
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**Pre-requisites: EC 383, EC383L and EC 351**

Microprocessor structure. Internal bus organization. Study of instruction set and its execution process with detailed timing analysis. Various microprocessor states. I/O processors; polled interrupt and DMA driven. System bus concept and simple interface design. Case studies of the contemporary microprocessors.

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| EC 482L | Microprocessor Systems Lab. | 1 Credits |
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**Pre-requisites: EC 383, EC383L and EC 351**

Accompanies EC 482

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| EC 483 | Microprocessor and Embedded Systems | 3 Credits |
|--------|-------------------------------------|-----------|

**Pre-requisites: EC 482, EC482L and EC 451**

This course is a continuation of the Microprocessor Systems. Include advanced contemporary processors architectures, memory interface, cache and memory management. Embedded systems and microcontroller technology, Microcontroller Architecture, internal RAM and Registers, microcontroller instructions and programming, interfacing the microcontroller with external memory and I/O devices, case study of an embedded system.

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|--------|---------------|-----------|
| EC 499 | B.Sc. Project | 4 Credits |
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**Pre-requisites: EC 483 and EC 441**

Professional problem - solving methods developed through intensive group and/or individual studies of significant engineering projects. Use of analytic, computer, and experimental techniques where applicable. Lecture and lab. work.

**المحتوى العلمي للمقررات الدراسية الاختيارية لقسم هندسة الحاسب**

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| <b>EC 501</b> | <b>Adaptive Signal Processing</b> | <b>3 Credits</b> |
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**Pre-requisites: EC547,EC448**

Modelling: Room acoustics and multipath propagation.

Adaptive filter structures: FIR, IIR, and filter banks. Adaptation and tracking algorithms: RLS and Kalman-based adaptation. Hyper model-based design of Kalman-based trackers and of algorithms with constant gains. LMS and RLS revisited. Analysis of adaptation speed and convergence. Frequency-domain adaptation. Effects of bad excitation and non-stationary signals.

Implementation: Practical aspects, numerical effects, fixed-point calculations, the use of signal processors.

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| <b>EC 511</b> | <b>Solid State Electronics</b> | <b>3 Credits</b> |
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**Pre-requisites: EC310**

Semiconductor materials, crystal lattice, energy bands and concentrations, carrier transport phenomena, p-n junction diode, different kinds of transistors; bipolar, microwave, power, switching and hetero-junction. Metal-semiconductor contacts, IFET, MESFET, MIS diode, MOS diode, charge-coupled device, MOSFET, nonvolatile memory devices, LED, semiconductor lasers, photoconductors, photodiodes, avalanche photodiodes, phototransistors.

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| <b>EC 512</b> | <b>Semiconductor Devices</b> | <b>3 Credits</b> |
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**Pre-requisites: EC313**

Elements of solid state physics. Light modulation. Display device, lasers, thermal detectors, photon devices, detector performance parameters, fiber optical wave devices. Crystal growth and epitaxy. Oxidation and film decomposition. Diffusion and ion implantation. Lithography and etching. Integrated devices such as passive components, bipolar technology, MOSFET technology, MESFET technology.

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| <b>EC 513</b> | <b>Optoelectronic Devices</b> | <b>3 Credits</b> |
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**Pre-requisites: EC313**

Electronic properties of optical semiconductors, effect of temperature and pressure on bandgap, carrier scattering phenomena, density of carries in intrinsic and extrinsic semiconductors. Optical processes in Semiconductors. High speed



lasers. strained Quantum Well Lasers. Quantum wire lasers, Quantum dot lasers current. Topics in semiconductor Lasers.

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| EC 514 | Digital Electronics | 3 Credits |
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**Pre-requisites: EC313, EC381**

Steady state and transient analysis of RTL, DTL, TTL, I<sup>2</sup>L, ECL, and CMOS integrated circuits. Study of internal circuitry of memories (RAM, EPROM etc.). CCD structures, interfacing of IC families and discrete circuits.

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| EC 520 | Internet Security | 3 Credits |
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**Pre-requisites: EC433**

Overview: computer hacking. Infections points. Defense mechanisms. Encryption & decryption basics. Secure encryption methods. Software attached security. Designing secure operating systems. Database security. Confidentiality, Integrity and availability. Computer communication networks security.

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|--------|----------------------------------------|-----------|
| EC 522 | TCP/IP Protocol Design and Programming | 3 Credits |
|--------|----------------------------------------|-----------|

**Pre-requisites: EC433**

TCP/IP protocol suite in details (network, transport and application layers), protocol formats and interactions, internet routing, IPv6, mobile IP, HMIP, Internet QoSs (Int-Serv, Diff-Serv, RSVP, IPoverATM), and Security (IPsec, EDS, RSA) protocols, architectures. Monitor and simulate internet protocols.

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| EC 523 | Distributed Computing | 3 Credits |
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**Pre-requisites: EC433, EC451**

Principles of distributed computing; architectures and middleware; servers, processes, and virtualization; upper-layer network protocols, inter-process communication and remote procedure calling; concurrency, synchronization and distributed algorithms, dependable distributed systems and fault tolerance.

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| EC 530 | High Speed Networks | 3 Credits |
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**Pre-requisites: EC433, EC433L**



This course address protocols, architectures and technologies of wired and wireless high speed networks, It includes MAC and DLC protocols, Resource management, Flow control, error detection and correction, and access technologies. Topics covered include, Fast and G Ethernets, PPP WANS, Switched WANS (ATM, Frame relay, MPLS), access technologies (SDH/SONET, Wireless LANs, 3G, and WiMAX), and new paradigms in optical switching (circuit, packet, and burst switching).

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| EC 531 | Data Communications | 3 Credits |
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**Pre-requisites: EC331, EC482**

Overview and Protocol Architecture, TCP/IP Data Transmission and Transmission Media, Signal Encoding and Digital Data Communication Schemes, Data Link Control Protocols and Multiplexing, Spread Spectrum  
Introduction to Circuit and Packet Switching, Introduction to Asynchronous Transfer Mode, Local Area Network Overviews and Introduction to High Speed LANs

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|--------|------------------------------|-----------|
| EC 532 | Optical Fiber Communications | 3 Credits |
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**Pre-requisites: EC331**

Optical fiber communication system, advantages of optical fiber communication, spectrum of light, ray theory transmission, electromagnetic mode theory for optical propagation, cylindrical fiber, single-mode and multimode fibers, lenses, numerical aperture. Delay :-Dispersion and Distortion. attenuation and modulation frequency. optical bandwidth. Graded index fiber. Optical fiber in networking.

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|--------|--------------------------|-----------|
| EC 534 | Satellite Communications | 3 Credits |
|--------|--------------------------|-----------|

**Pre-requisites: EC331**

Satellite communication systems. Satellites. Earth stations. Propagation models and Link budget design. Modulation, coding and encryption techniques. Management and regulations of satellite communication systems. Digital broadcasting. Internet using satellite networks. Mobile cellular satellite communications.



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| EC 537 | Digital Communications | 3 Credits |
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**Pre-requisites: EC331**

An introduction to digital communications systems and modulation and techniques, along with simulation experiments of communications systems and techniques in Matlab/Simulink. Description of AM and FM modulations, sampling and digitalization of signals, baseband and carrier-modulated digital transmission, signal detection in noise, inter-symbol interference and equalization, channel capacity, data compression techniques, error detection and correction methods.

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|--------|---------------------------------------------|-----------|
| EC 539 | Mobile Cellular and Wireless Communications | 3 Credits |
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**Pre-requisites: EC433**

Introduction to wireless communication systems, modern wireless communication systems, the cellular concept-system design fundamentals (frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, trunking and grade of service). mobile radio propagation:(large-scale path loss, small-scale fading and multi-path), multiple access techniques for wireless communications :- FDMA, TDMA, SDMA, packet radio, spread spectrum multiple access :- FHMA, CDMA, system capacity performance. Wireless systems and standards:- AMPS, N-AMPS, ETACS, IS-54, IS-136, GSM, DECT and PACS.

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| EC 540 | System Identification | 3 Credits |
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**Pre-requisites: EC446**

Parametric and nonparametric system identification. Experimental planning. Selection of model structure, parameters estimation. Least squares, stochastic interpretation. Minimum-variance prediction and control. Validation. Experimental design.

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| EC 542 | Data Acquisition & Control | 3 Credits |
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**Pre-requisites: EC441**

Process control fundamentals. Final control elements (operation actuators and control elements). Data conversion systems. Signal recovery and distribution. Errors in signal processing. Interface components and techniques. Standard interface systems. Real-time computer control. Integrity of computer control systems. Microprocessor-based (simple distillation column control system. position control system, Stepping motors and temperature control system ). PLC. Microcontrollers

**EC 543****Identification and Adaptive Control****3 Credits****Pre-requisites: EC547**

Transfer function and impulse response identification methods. Least square identification method, maximum likelihood. Recursive identification using least squares. Adaptive control using model reference techniques, self-tuning and self tracking control. Kalman filter and its applications to identification and adaptive control.

**EC 544****Coding Theory****3 Credits****Pre-requisites: EC331, EC381**

The Hamming and Lee Metrics, Description of Linear Block Codes by Matrices, Description of Linear Tree codes by Matrices, The Standard Array, step-by-step Decoding of Block Codes, Modular Representation of Linear Block codes, Linear Block Codes Equivalence, Maximum-Distance-Separable Codes Important Linear Block Codes: The Hamming codes, Optimum codes for the Binary Symmetric Channel, binary Codes with large Minimum Distance Read-Muller Codes.

**EC 545****Fuzzy Engineering****3 Credits****Pre-requisites: EC446**

Fuzzy function approximation. Learning in SAMS: unsupervised clustering and supervised gradient descent. Fuzzy control and CHAOS. Fuzzy throttle controller. Control surface learning. Fuzzy signal processing. Fuzzy hardware. Fuzzy adaptive resonance theory.



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| EC 546 | Nonlinear Control | 3 Credits |
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**Pre-requisites: EC446**

Phase plane construction: the isocline Lienard's methods. Describing functions and its applications. Lyapunov's Stability theory. Popov stability criterion.

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| EC 547 | Digital Control | 3 Credits |
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**Pre-requisites: EC446, EC446L**

Introduction to the analysis and design of discrete-time feedback control systems. Topics include: Sampling and reconstruction of signals: S/H circuit, A/D, and D/A conversions, review of the z-transform and its properties, modified Z-transform. Transfer Functions, Block Diagrams, and SFG for digital control systems. State-Variable Technique applied to digital control systems. Controllability, Observability, and Stability. Time-Domain and Z-Domain Analysis, comparison between continuous-data and sampled-data system responses are made, steady-state analysis and root locus. Frequency-Domain Analysis of digital control systems (Nyquist criterion, Bode plot). Design of Discrete-Data Control Systems (PID design, Phase-Lead and Phase Lag Controllers, Disturbance rejection, Pole-Zero cancellation, Deadbeat-response design). State-space feedback control and observer design, pole placement, state estimator design. Quantization effects.

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|--------|--------------------------------|-----------|
| EC 550 | Topics in Software Engineering | 3 Credits |
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**Pre-requisites: EC451, EC482**

Advanced topics in the area of Industrial applications of computers and microprocessors in process control.

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| EC 552 | Data Structures and Algorithms II | 3 Credits |
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**Pre-requisites: EC352, EC451**

Linked stacks and queues - application: the available space list, polynomial arithmetic. Recursion: divide and conquer, postponing the work-backtracking, look-ahead. Binary trees: tree sort, building a binary search tree, height balance - AVL trees, heaps. Expansion trees: Polish notation, Pascal implementation. Graphs: computer representation, graph traversal, topological sorting, shortest path algorithm.



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| EC 555 | Software Engineering | 3 Credits |
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**Pre-requisites: EC252, EC451**

Introduction to Software Engineering: Professional software development, Software engineering ethics. Software Process: Software process models, Process activities, Coping with change, The Rational Unified Process. Agile Software Development: Agile methods, Plan-driven and agile development, Extreme programming. Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management. System Modeling: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering. Architectural Design: Architectural design decisions, Architectural views, Architectural patterns, Application architectures.

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| EC 556 | Database systems design | 3 Credits |
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**Pre-requisites: EC352**

Part 1: Databases and Database Users (Database System Concepts and Architecture, Data Modeling Using the Entity Relationship Model, Enhanced Entity Relationship and UML Modeling). Part 2: (RELATIONAL MODEL: CONCEPTS, CONSTRAINTS, LANGUAGES, DESIGN, AND PROGRAMMING. The Relational Data Model and Relational Database Constraints, The Relational Algebra and Relational Calculus, Relational Database Design by ER and EER to Relational Mapping, SQL: Schema Definition, Basic Constraints, and Queries, More SQL: Assertions, Views, and Programming Techniques).

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| EC 557 | Pattern Recognition | 3 Credits |
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**Pre-requisites: EC 301, GS206**

Sensing, Segmentation, Feature extraction, training and Classification. The Bayesian decision theory, Maximum likelihood and Bayesian parameter estimation of known parametric form probability density functions, Nonparametric techniques of pattern classifications, Linear discriminate functions, and Neural networks, The Unsupervised learning and clustering.

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|--------|-------------------------|-----------|
| EC 558 | Artificial Intelligence | 3 Credits |
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**Pre-requisites: EC451, EC482**

Artificial intelligence (AI) is a research field that studies how to realize the intelligent human behaviors on a computer. The ultimate goal of AI is to make a computer that can learn, plan, and solve problems autonomously.

The main research topics in AI include: problem solving, reasoning, planning, natural language understanding, computer vision, automatic programming, machine learning, and so on.

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| EC 559 | Advance Programming using JAVA | 3 Credits |
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**Pre-requisites: EC451, EC483**

Advanced topics about JAVA micro-edition (JME) and JAVA enterprise edition (JEE).

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| EC 560 | Neural Networks | 3 Credits |
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**Pre-requisites: EC 351, EC446**

Biological neural networks and simple models. The artificial neuron model. Hopfield nets. Energy functions and optimization. Perceptions and threshold logic machines. Multiplayer networks and its applications.

Back propagation. Recurrent nets. Tress structured networks. Unsupervised learning. Hebbian learning. Principal component analysis. Competitive learning. Feature mapping. Self-organizing maps. Adaptive resonance theory. Hardware realization of ANNs.

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| EC 561 | Distributed Real Time Control Systems | 3 Credits |
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**Pre-requisites: EC446**

Embedded Control systems: Design, implementation and validation of hard and soft real-time embedded control systems. Practical implementation of a modern digital controllers. Real-time operating systems. Distributed Real-Time Systems: The building blocks of a distributed real-Time control systems, performance measures and validation. Current real-time communication systems and timing constraints. Design and implementation of distributed real-time control systems. Micro controllers: Architecture and programming, I/O hardware, real-time programming. Electronic systems that include micro controllers to perform specific dedicated applications are now days in applications use.



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| EC 572 | Numerical Analysis II | 3 Credits |
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**Pre-requisites: EC 372**

Sets of nonlinear equations: Newton method and its modifications. Large systems of linear equations: sparse matrix methods. Quadratures: Taylor, Runge-Kutta and multiroots methods. Adaptive quadratures. Initial values and boundary values problems. Stiff differential equations and stability.

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| EC 573 | Probabilistic Models | 3 Credits |
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**Pre-requisites: EC351, GS206**

Introduction to probability theory. Random processes. Markov chains. The basic structure of queuing systems. Performance measures of a queuing systems. Little's formula. Birth and death process models. Examples of queuing systems in equilibrium. Queuing systems with finite and infinite server and population models. Erlang blocking formulae. Method of stages.

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| EC 574 | Optimization Techniques | 3 Credits |
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**Pre-requisites: EC372**

Linear Programming: LP Formulations, Graphical and algebraic methods for solving LP's with many variables, Simplex and dual Simplex methods, Duality theory and sensitivity analysis, transportation problems, network problems and assignment problems. Nonlinear Programming: Single and multivariable unconstrained optimization, line search methods including bisection, equal interval, golden-section search. Parabolic interpolation and Newton methods; gradient optimization techniques and application including steepest descent and conjugate gradient methods. Lagrange multipliers for constrained optimization. Convexity, basic solutions, extreme values, duality, convergence rate, Lagrangian, KKT conditions. Optimization Solvers: MATLAB Optimization Tool Box, MS Excel Solver, AMPL and others.

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| EC 575 | Modeling and Simulation | 3 Credits |
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**Pre-requisites: EC 372 and EC451**

An introduction to modeling and simulation. Discrete and continues models. Discrete-event simulation: event-oriented and process-oriented approaches, time advance mechanisms, queues, queues disciplines and stopping rules, single-server model - case study. More complex models: case studies - memory model, simple batch computer system model. Monte-Carlo simulation. Probability concepts in



modeling and simulation. Simulation languages - short review of GPSS and SIMSCRIPT.

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| EC 577 | Intelligent Control Systems | 3 Credits |
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**Pre-requisites: EC447**

Robot Dynamics: Dynamics of flexible and rigid robots, linear parameterization, globally convergent algorithm, singular perturbations, time delay problems. Multiple and redundant robots, computational approaches to robot motion planning, C-space of a single, rigid object, obstacles in C-space. Artificial potential fields. Grasp and task-level planning. Trajectory planning. Position and force control.

Robot Control: Lagrangian and Hamiltonian formulation. Feedback linearization Design via Lyapunov's second method. Singular perturbations and integral manifolds. Robustness of adaptive control.

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| EC 578 | Soft Computing & Applications | 3 Credits |
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**Pre-requisites: EC451**

The course provides the comprehensive treatment of the constituent methodologies underlying soft computing, an evolving branch within the scope of computational intelligence that is drawing increasingly more attention as it develops. Its main features include fuzzy set theory, fuzzy systems, neural networks, genetic algorithms, hybrid systems, and fuzzy clustering which is aimed at solving real world problems such as decision-making, modeling, recognition, classification, and control problems. In particular, course put equal emphases on theoretical aspects of covered methodologies, as well as empirical observations and verifications of various applications in practice.

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| EC 579 | Computer Systems Performance Evaluation | 3 Credits |
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**Pre-requisites: EC451, EC482**

The course introduces the main concepts and techniques needed to plan the capacity of computer systems, predict their future performance under different configurations, and design new applications that meet performance requirements. The techniques are applied to study the performance of centralized, distributed, parallel, client/server systems. The course provides the students with hands-on experience in performance evaluation through a project.



The concept and applications of software performance engineering are also covered.

**EC 580****Special Topics in Digital Systems****3 Credits****Pre-requisites: EC451, EC482**

Computer Architecture: Design methodology. CPU and ALU design. Hardware and micro programmed control. Interrupt and DMA I/O processors. VLSI, VHDL. Logic Circuit Synthesis and Optimization: Advanced design of logic circuits. Multilevel optimization of combinational circuits. Optimization of finite-state machines. Computer- aided design algorithms.

**EC 582****FPGA Design for Embedded Systems****3 Credits****Pre-requisites: EC482**

With the advance of semiconductor technology, the complexity of digital circuits has increased to a level that circuit designers cannot handle without the help of modern sophisticated Electronic Design Automation (EDA) tools. This course covers the use of Verilog HDL in high-level synthesis of digital system designs. The language Verilog HDL as well as how it is used for describing, modeling, simulating and synthesizing various digital modules. Verilog HDL coding and synthesis issues on combinational and sequential modules including Finite State Machine will be discussed. In the hands-on sessions, students will synthesize and test the designs with industrial software packages (ModelSim / Quartus II) and FPGA devices. The course comprises lecture sessions on Verilog HDL language, hands-on sessions on coding, synthesis and simulation. The course study will also involve extensive lab experiments to give students hands-on experience on designing digital systems on FPGA platforms and going through a complete cycle of design.

**EC 583****VLSI Systems****3 Credits****Pre-requisites: EC483**

VHDL: Modeling systems behavior in VHDL. Automated/ manual synthesis. Testing and design for testability.

Top-down VLSI design methodology. CAD tools in the VLSI CMOS circuit and subsystem design. Design tools. Simulation and verification methods. Advanced VLSI Circuits: Architecture and circuit level design and analysis of integrated A/D



and D/A interfaces in CMOS and BICMOS VLSI technology. CAD tools for analog design including simulation and synthesis.

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| <b>EC 584</b> | <b>Design of Fault-Tolerant Digital Systems</b> | <b>3 Credits</b> |
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**Pre-requisites: EC414**

Fault-tolerant computing, demonstration of error detection and recovery. Hardware and software models. Fault –tolerant techniques, coding, check pointing recovery. Reliable networked systems. Security. Case studies of reliable system design.

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| <b>EC 585</b> | <b>Computer Architecture</b> | <b>3 Credits</b> |
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**Pre-requisites: EC 483 and EC451**

This course deals with the design and performance evaluation of advanced/high performance computer systems. The emphasis is on microprocessors, chip-multiprocessors and memory hierarchy design. Historical information is presented as well as along with data storage and low-power dissipation schemes. Special attention is paid to pipelining, ILP (instruction-level parallelism), DLP (data-level parallelism) and TLP (thread-level parallelism) using hardware and software techniques to yield high performance.

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| <b>EC 586</b> | <b>Computer Graphics</b> | <b>3 Credits</b> |
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**Pre-requisites: EC372 and EC 352**

Computer graphics fundamentals and applications. Computer graphics application: survey. Graphic I/O devices and systems. Graphics output primitives. Two-dimensional transformation. Intro, to interactive graphics: user interface and graphics modeling techniques.

Intro, to three-dimensional graphics transformation: hidden lines, hidden surfaces problems.

Famous graphics packages and CAD software.

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| <b>EC 587</b> | <b>Digital Systems Testing &amp; Simulation</b> | <b>3 Credits</b> |
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**Pre-requisites: EC482**

Modeling, Logic simulation, Event driven simulator. Automatic test pattern generation. Path systemization, D-algorithm, PODEM, FAN. Fault simulation:



Serial, parallel, detective and concurrent. Design for testability: Scan path, LSSD, Signature analysis, and Functional testing.

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| EC 588 | Switching Theory | 3 Credits |
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**Pre-requisites: EC482**

Finite state automata. Functional decomposition. Threshold logic. Multistage logic. Synchronous and asynchronous sequential design. Sequential circuit decomposition. Fault detection and diagnosis in combinational and sequential machines.

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| EC 589 | Computer Aided Design | 3 Credits |
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**Pre-requisites: EC 313 and EC 372**

Software system for computer-aided design of the electronic circuits - an overview. Computer programs for electronic circuit analysis. Models of the circuit elements: diode, bipolar and transistor. Nodal and modified nodal methods - the realization in computer programs. AC and sensitivity analysis. Mathematical methods in computer analysis of the electronic circuits.

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| EC 590 | Computer & Society | 3 Credits |
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**Pre-requisites: EC451 and EC482**

The course is an introductory examination of the effects of computer technology on contemporary society. Topics include productivity applications, creation of Web pages, and societal and ethical issues in computing; privacy, security, censorship, and the changes in work, school, and entertainment fostered by computing. The course is seminar based. Students taking the course will be divided into groups. Topics or mini projects will be assigned to each group, and students will be expected to engage with others in group work activities.

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| EC 591 | Parallel Processing | 3 Credits |
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**Pre-requisites: EC 301 and EC 585**

Parallel architecture, dynamic interconnection networks, static interconnection networks, hypercube architecture, routing mechanisms, communication costs, cost-performance trade-offs, communication operations, performance of parallel



systems, parallel algorithms, matrix algorithms, sorting, search algorithms, graph algorithms.

EC 593

Digital Image Processing

3 Credits

**Pre-requisites: EC 301**

Image enhancement, restoration, and color image processing. Digital image generation, adjacency, connectivity, regions and boundaries, Frequency domain analysis, Image enhancement techniques in spatial and frequency domains, Image restoration in spatial and frequency domain (in presence of noise and other degradations), Color image processing, Image lossless and lossy compression.