# English Version

## Tables of Marks

## Marks of courses are given as:

### 1- Courses with Labs

| Exam | Final | Midterm Exam | Year work | Lab &Oral | Total |
|------|-------|--------------|-----------|-----------|-------|
| **Marks** | **40** | **20** | **20** | **20** | **100** |

### 2- Courses without Labs

| Exam | Final | Midterm Exam | Year work | Total |
|------|-------|--------------|-----------|-------|
| **Marks** | **40** | **20** | **40** | **100** |

## University Requirements Courses UR (19 Credit Hrs)

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| English 1 | UR 041 | 1 | 2 | - | 3 | 2 | 0 |
| English 2 | UR 042 | 2 | 2 | - | 4 | 3 | 0 |
| Environmental Eng. | UR 142 | 2 | - | - | 2 | 2 | 1 |
| History of Eng. Science | UR 143 | 2 | - | - | 2 | 2 | 1 |
| Human rights | UR 345 | 2 | - | - | 2 | 2 | 3 |
| Engineering economics | UR 446 | 2 | - | - | 2 | 2 | 4 |
| Quality assurance standards | UR 247 | 2 | - | - | 2 | 2 | 2 |
| Technical Reports Writing | UR 347 | 1 | 2 | - | 3 | 2 | 3 |
| Project management | UR 448 | 2 | - | - | 2 | 2 | 4 |

## Statistical table for UR courses

| Total credit | Level |
|--------------|-------|
| **5** | 0 |
| 4 | 1 |
| 2 | 2 |
| 4 | 3 |
| 4 | 4 |

# College Requirements Engineering Courses CR (58 Credit Hrs)

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|---|---|---|---|---|---|---|---|
| Mathematics 1 | CR 001 | 2 | 2 | - | 4 | 3 | 0 |
| Mathematics 2 | CR 002 | 2 | 2 | - | 4 | 3 | 0 |
| Eng. Mathematics1 | CR 106 | 2 | 2 | - | 4 | 3 | 1 |
| Eng. Mathematics2 | CR 107 | 2 | 2 | - | 4 | 3 | 1 |
| Probability theory and random variables | CR 208 | 2 | 2 | - | 4 | 3 | 2 |
| Signal analysis | CR 209 | 2 | 2 | - | 4 | 3 | 2 |
| Eng. Mechanics 1 | CR 003 | 2 | 2 | - | 4 | 3 | 0 |
| Eng. Mechanics 2 | CR 004 | 2 | 2 | - | 4 | 3 | 0 |
| Physics 1 | CR 011 | 2 | 2 | 3 | 7 | 4 | 0 |
| Physics 2 | CR 013 | 2 | 2 | 3 | 7 | 4 | 0 |
| Eng. Chemistry | CR 021 | 2 | 2 | 3 | 7 | 4 | 0 |
| Engineering drawing using computer | CR 031 | 1 | - | 6 | 7 | 3 | 0 |
| Electronic circuits and components drawing using computer | CR 131 | 1 | - | 6 | 7 | 3 | 1 |
| Solid state Physics | CR 132 | 2 | 2 | - | 4 | 3 | 1 |
| Mechanical workshop | CR 032 | 1 | - | 3 | 4 | 2 | 0 |

## Statistical Table for CR courses

| Total Credit Hrs. | Level |
|---|---|
| 29 | 0 |
| 12 | 1 |
| 6 | 2 |
| 0 | 3 |
| 0 | 4 |

# Specialization Requirement (<u>Major</u>) Courses for Biomedical engineering & technology (56 Credit Hrs)

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|---|---|---|---|---|---|---|---|
| Electrical Eng. | ACE 161 | 2 | 2 | - | 4 | 3 | 1 |
| Electrical circuits | ACE 261 | 2 | 2 | 3 | 7 | 4 | 2 |
| Electronics 1 | ACE 171 | 2 | 2 | 3 | 7 | 4 | 1 |
| Electronics 2 | ACE 172 | 2 | 2 | 3 | 7 | 4 | 1 |
| Electronic Circuits | ACE 264 | 2 | 2 | 3 | 7 | 4 | 2 |
| Electric Power and Machines Eng. | ACE272 | 2 | 2 | - | 4 | 3 | 2 |
| Fields and waves | ECE 262 | 2 | 2 | - | 4 | 3 | 2 |
| Physiology | ACE 263 | 2 | 2 | 3 | 7 | 4 | 2 |
| Computer Programming 1 | CSE051 | 2 | - | 3 | 5 | 3 | 0 |
| Computer Programming 2 | CSE151 | 2 | - | 3 | 5 | 3 | 1 |
| Computer Eng. | CSE251 | 2 | - | 3 | 5 | 3 | 2 |
| Biochemistry | ACE 173 | 2 | 2 | - | 4 | 3 | 2 |
| Electrical safety | ACE 274 | 2 | 2 | 3 | 7 | 4 | 2 |
| Anatomy | ACE 181 | 2 | 2 | - | 4 | 3 | 1 |
| Electrical Measurements | ACE 281 | 1 | - | 6 | 7 | 3 | 2 |
| Applied Project | ACE 282 | 1 | - | 3 | 4 | 2 | 2 |
| Summer Training 1 | ACE 090 | - | - | 3 | 3 | 1 | 0 |
| Summer Tanning 2 | ACE 190 | - | - | 3 | 3 | 1 | 1 |
| Summer Training 3 | ACE 290 | - | - | 3 | 3 | 1 | 2 |

# Statistical Table for Specialization Courses

| Total Credit Hrs. | Level |
|---|---|
| 4 | 0 |
| 18 | 1 |
| 34 | 2 |
| 0 | 3 |
| 0 | 4 |

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## Minor Requirement Courses for Biomedical engineering & technology (53 Credit Hrs)

## 1- Minor Requirement Compulsory courses (35 Credit Hrs)

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|---|---|---|---|---|---|---|---|
| Automatic control | ACE 302 | 2 | 2 | 3 | 7 | 4 | 3 |
| Medical electronics | ACE 311 | 2 | 2 | - | 4 | 3 | 3 |
| Digital signal processing | ACE 375 | 2 | 2 | - | 4 | 3 | 3 |
| Microcontrollers and Embedded Systems | ACE 420 | 2 | 2 | 3 | 7 | 4 | 4 |
| Biomedical Instrumentation | ACE 431 | 2 | 2 | - | 4 | 3 | 4 |
| Electrophysiological measurements | ACE 484 | 2 | 2 | - | 4 | 3 | 4 |
| Introduction to Biomedical Optics | ACE 385 | 2 | 2 | - | 4 | 3 | 3 |
| Biomedical Imaging Systems | ACE 386 | 2 | 2 | - | 4 | 3 | 3 |
| Intelligent control systems | ACE 387 | 2 | - | 3 | 5 | 3 | 3 |
| mechatronics | ACE 478 | 2 | - | 3 | 5 | 3 | 4 |
| Graduation Project | ACE 480 | 1 | - | 9 | 10 | 4 | 4 |

## Statistical Table for Minor Compulsory Courses

| Total Credit Hrs. | Level |
|---|---|
| 0 | 0 |
| 0 | 1 |
| 0 | 2 |
| 19 | 3 |
| 16 | 4 |

## 2- Minor Requirement  Specialization Elective Courses (18 Credits Hrs), Student should choose 4 courses (12 Credits Hrs ) from List 1 in level 3, and 2 courses (8 Credits Hrs ) from List 2 in level 4
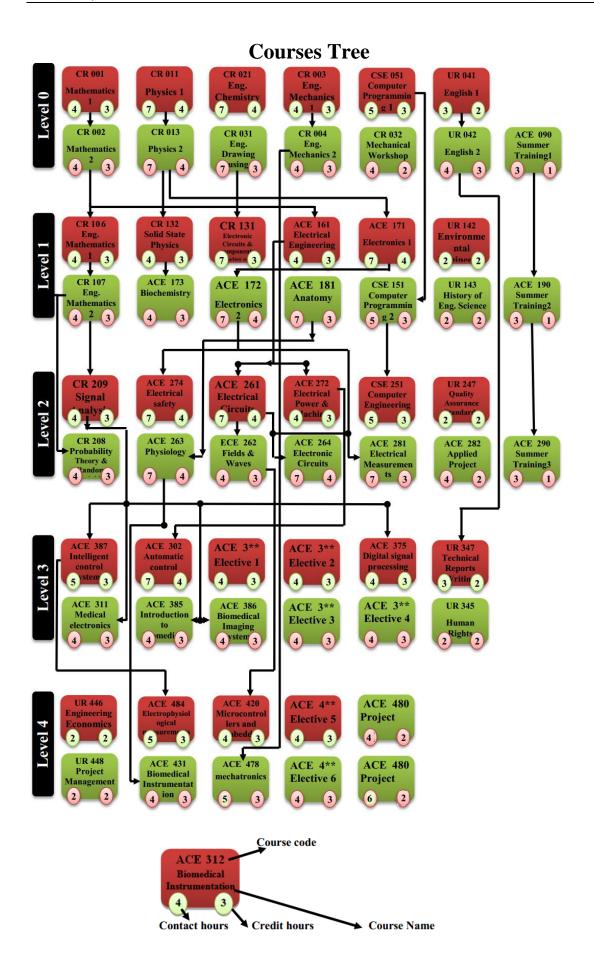
### List 1

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Biomedical Image Processing | ACE 328 | 2 | 2 | - | 4 | 3 | 3 |
| Artificial neural networks | ACE 329 | 2 | 2 | - | 4 | 3 | 3 |
| Computer Tomography | ACE 330 | 2 | 2 | - | 4 | 3 | 3 |
| Tissue Engineering | ACE 331 | 2 | 2 | - | 4 | 3 | 3 |
| Modeling and simulation | ACE 332 | 2 | 2 | - | 4 | 3 | 3 |
| VLSI Technology | ACE 333 | 2 | 2 | - | 4 | 3 | 3 |
| Nano Devices | ACE 334 | 2 | 2 | - | 4 | 3 | 3 |
| Programmable Logic Controllers | ACE 335 | 2 | - | 3 | 5 | 3 | 3 |
| Real Time Control Systems | ACE 336 | 2 | 2 | - | 4 | 3 | 3 |
| Biofluid mechanics | ACE 337 | 2 | 2 | - | 4 | 3 | 3 |
| Organic chemistry | ACE 338 | 2 | 2 | - | 4 | 3 | 3 |
| Random processes | ACE 339 | 2 | 2 | - | 4 | 3 | 3 |
| Biostatistics | ACE 340 | 2 | 2 | - | 4 | 3 | 3 |

### List 2

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Advanced Biomedical Image processing | ACE 441 | 2 | 2 | - | 4 | 3 | 4 |
| Pattern Recognition in Machines & Bio. Systems | ACE 442 | 2 | 2 | - | 4 | 3 | 4 |
| Design of Assistive Devices | ACE 443 | 2 | 2 | - | 4 | 3 | 4 |
| Clinical Engineering | ACE 444 | 2 | 2 | - | 4 | 3 | 4 |
| Biomechanics | ACE 445 | 2 | 2 | - | 4 | 3 | 4 |
| Kinetics and Thermodynamics of Biological Systems | ACE 446 | 2 | 2 | - | 4 | 3 | 4 |
| Renewable energy | ACE 447 | 2 | 2 | - | 4 | 3 | 4 |
| Telemedicine | ACE 448 | 2 | 2 | - | 4 | 3 | 4 |
| Nuclear medicine | ACE 449 | 2 | 2 | - | 4 | 3 | 4 |

**Indicative curricula by subject area (NARS CHARACTERIZATION)**

| Subject Area | Credits Hrs | Percentage | The recommendations of NARS for the percentages for each category | | |
|---|---|---|---|---|---|
| | | | Minimum | Maximum | Average |
| **A Humanities and Social Sciences** | 19 | 10.86% | 9 | 12 | 11 |
| **Mathematics and Basic Sciences** | 39 | 22.285 % | 20 | 26 | 21 |
| **Basic Engineering Sciences** | 39 | 22.285 % | 20 | 23 | 21 |
| **Applied Engineering and Design** | 37 | 21.14% | 20 | 22 | 21 |
| **Computer Applications and ICT** | 18 | 10.29% | 9 | 11 | 10 |
| **Projects and Practice** | 14 | 8.00% | 8 | 10 | 9 |
| **Subtotal** | 166 | 94.86% | 92 | 93 | 94 |
| **Discretionary subjects** | 9 | 5.14% | 6 | 8 | 7 |
| **Total** | 175 | 100.00% | | | 100 |

# Courses Tree

**Level 0**

| CR 001 Mathematics 1 — 4, 3 | CR 011 Physics 1 — 7, 4 | CR 021 Eng. Chemistry — 7, 4 | CR 003 Eng. Mechanics 1 — 4, 3 | CSE 051 Computer Programming 1 — 5, 3 | UR 041 English 1 — 3, 2 |

| CR 002 Mathematics 2 — 4, 3 | CR 013 Physics 2 — 7, 4 | CR 031 Eng. Drawing using — 7, 3 | CR 004 Eng. Mechanics 2 — 4, 3 | CR 032 Mechanical Workshop — 4, 3 | UR 042 English 2 — 4, 3 | ACE 090 Summer Training1 — 3, 1 |

**Level 1**

| CR 106 Eng. Mathematics 1 — 4, 3 | CR 132 Solid State Physics — 4, 3 | CR 131 Electronic Circuits & Components using — 7, 3 | ACE 161 Electrical Engineering — 7, 4 | ACE 171 Electronics 1 — 7, 4 | UR 142 Environmental Engineering — 2, 2 |

| CR 107 Eng. Mathematics 2 — 4, 3 | ACE 173 Biochemistry — 4, 3 | ACE 172 Electronics 2 — 7, 4 | ACE 181 Anatomy — 7, 3 | CSE 151 Computer Programming 2 — 5, 3 | UR 143 History of Eng. Science — 2, 2 | ACE 190 Summer Training2 — 3, 1 |

**Level 2**

| CR 209 Signal Analysis — 4, 3 | ACE 274 Electrical safety — 7, 4 | ACE 261 Electrical Circuits — 7, 4 | ACE 272 Electrical Power & Machine — 7, 4 | CSE 251 Computer Engineering — 5, 3 | UR 247 Quality Assurance Standard — 2, 2 |

| CR 208 Probability Theory & Random — 4, 3 | ACE 263 Physiology — 7, 4 | ECE 262 Fields & Waves — 4, 3 | ACE 264 Electronic Circuits — 7, 4 | ACE 281 Electrical Measurements — 7, 4 | ACE 282 Applied Project — 4, 2 | ACE 290 Summer Training3 — 3, 1 |

**Level 3**

| ACE 387 Intelligent control system — 5, 3 | ACE 302 Automatic control — 7, 4 | ACE 3** Elective 1 — 4, 3 | ACE 3** Elective 2 — 4, 3 | ACE 375 Digital signal processing — 4, 3 | UR 347 Technical Reports Writing — 3, 2 |

| ACE 311 Medical electronics — 4, 3 | ACE 385 Introduction to medical — 4, 3 | ACE 386 Biomedical Imaging system — 4, 3 | ACE 3** Elective 3 — 4, 3 | ACE 3** Elective 4 — 4, 3 | UR 345 Human Rights — 2, 2 |

**Level 4**

| UR 446 Engineering Economics — 2, 2 | ACE 484 Electrophysiological measurements — 5, 3 | ACE 420 Microcontrollers and embedded — 4, 3 | ACE 4** Elective 5 — 4, 3 | ACE 480 Project — 4, 2 |

| UR 448 Project Management — 2, 2 | ACE 431 Biomedical Instrumentation — 4, 3 | ACE 478 mechatronics — 5, 3 | ACE 4** Elective 6 — 4, 3 | ACE 480 Project — 6, 2 |

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**Legend:**

ACE 312 Biomedical Instrumentation — 4, 3

- Course code
- Contact hours
- Credit hours
- Course Name

# Prerequisites of Specialization Elective Courses

## List 1

| Title | Code | Prerequisite Code |
|---|---|---|
| Biomedical image processing | ACE 328 | CSE 151 |
| Artificial neural networks | ACE 329 | ACE 281 |
| Computer tomography | ACE 330 | CSE 251 |
| Tissue engineering | ACE 331 | ACE 181 |
| Modeling and simulation | ACE 332 | ACE 264 |
| Vlsi technology | ACE 333 | ACE 264 |
| Nano devices | ACE 334 | CR 132 |
| Programmable logic controllers | ACE 335 | ACE 272 |
| Real time control systems | ACE 336 | ACE 272 |
| Biofluid mechanics | ACE 337 | ACE 173 |
| Organic chemistry | ACE 338 | CR  021 |
| Random processes | ACE 339 | CR 208 |
| Biostatistics | ACE 340 | CR 107 |

## List 2

| Title | Code | Prerequisite Code |
|---|---|---|
| Advanced Biomedical Image processing | ACE 441 | ACE 375 |
| Pattern Recognition in Machines & Bio. Systems | ACE 442 | ACE 387 |
| Design of Assistive Devices | ACE 443 | ACE 375 |
| Clinical engineering | ACE 444 | ACE 311 |
| Biomechanics | ACE 445 | CR 004 |
| Kinetics and Thermodynamics of Biological Systems | ACE 446 | ACE 181 |
| Renewable energy | ACE 447 | ACE 172 |
| Telemedicine | ACE 448 | ACE 281 |
| Nuclear medicine | ACE 449 | ACE 386 |

# Table for Level 0

## First term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Mathematics 1 | CR 001 | 2 | 2 | - | 4 | 3 | 0 |
| Physics 1 | CR 011 | 2 | 2 | 3 | 7 | 4 | 0 |
| Eng. Chemistry | CR 021 | 2 | 2 | 3 | 7 | 4 | 0 |
| Eng. Mechanics 1 | CR 003 | 2 | 2 | - | 4 | 3 | 0 |
| Computer Programming 1 | CSE051 | 2 | - | 3 | 5 | 3 | 0 |
| English 1 | UR 041 | 1 | 2 | - | 3 | 2 | 0 |
| Total | | 11 | 10 | 9 | 30 | 19 | 0 |

## Second term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Mathematics 2 | CR 002 | 2 | 2 | - | 4 | 3 | 0 |
| Physics 2 | CR 013 | 2 | 2 | 3 | 7 | 4 | 0 |
| Eng. Mechanics 2 | CR 004 | 2 | 2 | - | 4 | 3 | 0 |
| Engineering drawing using computers | CR 031 | 1 | - | 6 | 7 | 3 | 0 |
| English 2 | UR 042 | 2 | 2 | - | 4 | 3 | 0 |
| Mechanical workshop | CR 032 | 1 | - | 3 | 4 | 2 | 0 |
| Total | | 10 | 8 | 12 | 30 | 18 | 0 |

| Term | code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|------|------|---------|----------|-----|-------------|------------------|-------|
| Summer training1 | ACE 090 | - | - | 3 | 3 | 1 | 0 |

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# Table for Level 1

## First term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Eng Mathematics 1 | CR 101 | 2 | 2 | - | 4 | 3 | 1 |
| Electronic circuits and components drawing using computerS | CR 131 | 1 | - | 6 | 7 | 3 | 1 |
| Electrical Eng. | ACE161 | 2 | 2 | - | 4 | 3 | 1 |
| Solid state Physics | CR 132 | 2 | 2 | - | 4 | 3 | 1 |
| Electronics 1 | ACE171 | 2 | 2 | 3 | 7 | 4 | 1 |
| Environmental Eng. | UR 142 | 2 | | - | 2 | 2 | 1 |
| Total | | 11 | 8 | 9 | 28 | 19 | 0 |

## Second term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Eng. Mathematics 2 | CR 107 | 2 | 2 | - | 4 | 3 | 1 |
| Electronics 2 | ACE172 | 2 | 2 | 3 | 7 | 4 | 1 |
| Biochemistry | ACE173 | 2 | 2 | - | 4 | 3 | 2 |
| Anatomy | ACE181 | 2 | 2 | - | 4 | 3 | 1 |
| Computer Programming 2 | CSE151 | 2 | - | 3 | 7 | 3 | 1 |
| History of Eng. Science | UR 143 | 2 | - | - | 2 | 2 | 1 |
| Total | | 11 | 6 | 12 | 29 | 18 | 1 |

| Term | code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|------|------|---------|----------|-----|-------------|------------------|-------|
| Summer training2 | ACE 190 | - | - | 3 | 3 | 1 | 1 |

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# Table for Level 2
## First term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|---|---|---|---|---|---|---|---|
| Signal analysis | CR 209 | 2 | 2 | - | 4 | 3 | 2 |
| Electrical circuits | ACE 261 | 2 | 2 | 3 | 7 | 4 | 2 |
| Electrical safety | ACE 274 | 2 | 2 | 3 | 7 | 4 | 2 |
| Electrical Power and Machines Eng. | ACE272 | 2 | 2 | - | 4 | 3 | 2 |
| Computer Eng. | CSE251 | 2 | - | 3 | 5 | 3 | 2 |
| Quality assurance standards | UR 247 | 2 | - | - | 2 | 2 | 2 |
| Total | | 11 | 8 | 9 | 28 | 18 | 2 |

## Second term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|---|---|---|---|---|---|---|---|
| Electronic Circuits | ACE 264 | 2 | 2 | 3 | 7 | 4 | 2 |
| Fields and waves | ECE 262 | 2 | 2 | - | 4 | 3 | 2 |
| Physiology | ACE 263 | 2 | 2 | 3 | 7 | 4 | 2 |
| Electrical Measurements | ACE 281 | 1 | - | 6 | 7 | 3 | 2 |
| Probability theory and random variables | CR 208 | 2 | 2 | - | 4 | 3 | 2 |
| Applied Project | ACE 282 | 1 | - | 3 | 4 | 2 | 2 |
| Total | | 9 | 8 | 15 | 32 | 19 | 2 |

| Term | code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|---|---|---|---|---|---|---|---|
| Summer training3 | ACE 290 | - | - | 3 | 3 | 1 | 2 |

# Table for Level 3

## First term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Intelligent control systems | ACE 387 | 2 | - | 3 | 5 | 3 | 3 |
| Automatic control | ACE 302 | 2 | 2 | 3 | 7 | 4 | 3 |
| Digital signal processing | ACE 375 | 2 | 2 | - | 4 | 3 | 3 |
| Elective 1 | ACE 3** | 2 | 2 | - | 4 | 3 | 3 |
| Elective 2 | ACE 3** | 2 | 2 | - | 4 | 3 | 3 |
| Technical reports writing | UR 347 | 1 | 2 | - | 3 | 2 | 3 |
| Total | | 9 | 10 | 9 | 28 | 16 | |

## Second term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Medical electronics | ACE 311 | 2 | 2 | - | 4 | 3 | 3 |
| Introduction to Biomedical Optics | ACE 385 | 2 | 2 | - | 4 | 3 | 3 |
| Biomedical Imaging Systems | ACE 386 | 2 | 2 | - | 4 | 3 | 3 |
| Elective 3 | ACE 3** | 2 | 2 | - | 4 | 3 | 3 |
| Elective 4 | ACE 3** | 2 | 2 | - | 4 | 3 | 3 |
| Human rights | UR 345 | 2 | - | - | 2 | 2 | 3 |
| Total | | 11 | 10 | – | 21 | 15 | |

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# Table for Level 4

## First term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Engineering economics | UR 446 | 2 | - | - | 2 | 2 | 4 |
| Microcontrollers and Embedded Systems | ACE 420 | 2 | 2 | - | 4 | 3 | 4 |
| Electrophysiological measurements | ACE 484 | 2 | 2 | - | 4 | 3 | 4 |
| Elective 5 | ACE 4** | 2 | 2 | - | 4 | 3 | 4 |
| Project | ACE 480 | 1 | - | 3 | 4 | 2 | 4 |
| Total | | 9 | 4 | 6 | 19 | 13 | |

## Second term

| Title | Code | Lecture | Tutorial | Lab | Contact Hrs | Total credit Hrs | Level |
|-------|------|---------|----------|-----|-------------|------------------|-------|
| Project management | UR 448 | 2 | - | - | 2 | 2 | 4 |
| Mechatronics | ACE 478 | 2 | - | 3 | 5 | 3 | 4 |
| Biomedical Instrumentation | ACE 431 | 2 | 2 | - | 4 | 3 | 4 |
| Elective 6 | ACE 4** | 2 | 2 | - | 4 | 3 | 4 |
| Project | ACE 480 | - | - | 6 | 6 | 2 | 4 |
| Total | | 8 | 6 | 6 | 20 | 13. | |

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# Courses Contents and Descriptions
## 1-Level 0

## First term

| Code | CR 001 |
|---|---|
| **Field** | **College Requirements Eng.** |
| **Title** | **Mathematics 1** |
| **Credits** | 3Hrs (2 lec + 1Tut) |
| **Prerequisite** | - |
| **Description** | **Functions – limits – continuity – differentiation and applications – integration– methods of integration –proper integration- improper integration -Binomial theory- partial fractions** |

| Code | CR 011 |
|---|---|
| **Field** | **College Requirements Eng** |
| **Title** | **Physics 1** |
| **Credits** | 4 Hrs (2 lec + 1Tut + 1Lab) |
| **Prerequisite** | - |
| **Description** | **Physical quantities – units and dimensions – field of gravitational force and its application – fluid statics and dynamics – viscosity – elasticity- sound waves – waves in elastic media – heat transfer – Kinetic theory of gases** <br><br> **Practical part:** <br> **Determination of sound speed in air – Determination of viscosity using stok's low- Determination of gravitational force - Verfication of stok's law and elasticity constant estimation - Determination hardness coefficient for a wire - Specific heat of the oil had to be a way that electrical Basthaddam priced Gul- The achievement of Boyle's law of gases- Determination of Specific heat of a solid body by mixing - Determination of the coefficient of linear expansion** |

| Code | CR 021 |
|---|---|
| **Field** | **College Requirements Eng** |
| **Title** | **Eng. Chemistry** |
| **Credits** | 4 Hrs (2 lec + 1Tut + 1Lab) |

| Prerequisite | - |
|---|---|
| Description | State equation –thermodynamic chemistry- material and thermal scale in full burning and chemical process- solvent properties- dynamic stability of chemical and physical process- chemical interaction mobility-Electrochemistry-introduction to corrosion engineering - semiconductor chemistry and fabrication.<br><br>**Practical part:**<br>Safty guidlines – Density of liquids and solids – compound types – Chemical Reactions – Synthesis of a compound – Empirical formula- Gas Laws – Acids and Bases – Le Chatliere's Principles- molar mass of acid – Titration of Antacids – Titration of Vinegar –colligative properties – calorimtry – kinetics – Beer's Law |

| Code | CR 003 |
|---|---|
| Field | College Requirements Eng |
| Title | Eng. Mechanics 1 |
| Credits | 3 Hrs (2 lec + 1Tut ) |
| Prerequisite | - |
| Description | statics- moments- moments of inertia- Newton laws- Vectors and forces in space– particle equilibrium – center of mass and geometrical center- distributed forces-application of hydrostatics – friction and its applications- |

| Code | CSE 051 |
|---|---|
| Field | Specialization Requirements |
| Title | Computer programming 1 |
| Credits | 3 Hrs (2 lec + 1Lab) |
| Prerequisite | - |
| Description | Techniques of engineering problems- solution in communication engineering- field of information systems- development of planned programs using c++ language-improving, translation, and correction of programs- |

| Code | UR 041 |
|---|---|
| Field | University req. |
| Title | English 1 |
| Credits | 2 Hrs (1 lec + 1Tut) |

| Prerequisite | - |
|---|---|
| **Description** | **Chosen compositions in engineering subjects for training on investigating and quick reading- reports writing- information transfer- development of language communication by discussion subjects, and summary writing** |

# Second term

| Code | **CR 002** |
|---|---|
| **Field** | **College Requirements Eng** |
| **Title** | **Mathematics 2** |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | **Mathematics 1 CR 001** |
| **Description** | **Integration methods- integration by substitution- successive reduction- triangular substitution- finite integration and its properties –upper and lower rayman collection – basic theory of integration – improper integration – integration application- calculation of rotational areas and volume – integration by approximation – trapezoidal and Simpson rule- Cartesian coordinate and its application – analytical geometry: second order equation – straight line pairs- circle and circle groups – conical sectors – analytical geometry in space – coordinate disciplines- straight line equation** |

| Code | **CR 013** |
|---|---|
| **Field** | **College Requirements Eng** |
| **Title** | **Physics 2** |
| **Credits** | 4 Hrs (2 lec + 1Tut + 1Lab) |
| **Prerequisite** | **Physics 1 CR 011** |
| **Description** | **Electricity and magnetism: Charge and matter – electric field – Coulomb law- electrical flux- Gauss's law – electric potential – capacitors and dielectrics – current, resistance and electromotive force – magnetic field – Ohm's law and simple circuits- Biot and Savart law – Faraday's law of induction – inductance – magnetic properties of matter – Maxwell's equations – Light: Geometrical optics, wave physics of light and Huggen's principle- interference and diffraction- light polarization and fiber optics. Atomic physics: atomic structure, Boher theory- basic of quantum theory- Laser –electro optics phenomena – reletivity theory**<br><br>**Practical part:**<br>**The verifing Ohm's law and Determination the resistivity of the wire – Divergence from Ohm's law and the finding of the relationship between the voltage and current – Determine** |

self inductance of the coil – verifying Ohm's law in a capacitor using alternating current – Metric Bridge – Determination of electrochemical equivalent for Copper – The Determination of horizontal component of magnetic field of the earth - The magnetic field lines for a magnetic rod – Determination of a focal length of convex lens and a concave lense using a flat mirror - Determination of the focal length of the concave mirror – Determination of the Refraction coefficient of a liquid

| Code | CR 004 |
|---|---|
| Field | College Requirements Eng |
| Title | Eng. Mechanics 2 |
| Credits | 3 Hrs (2 lec + 1Tut) |
| Prerequisite | Eng. Mechanics 1  CR 003 |
| Description | Engineering dynamics: particle dynamics - Newton's law of motion –equation of motion in different coordinates –work and energy of the particles – conservative groups and potential function – frictions and its applications  in linear motion – rigid particle motion- plane motion types and transferable, rotational and general – dynamics of rigid particle |

| Code | CR 031 |
|---|---|
| Field | College Requirements Eng |
| Title | Engineering Drawing using Computer |
| Credits | 3 Hrs (1 lec + 2Lab) |
| Prerequisite | - |
| Description | Principles of engineering drawing – engineering language – analysis and investigation of engineering drawing – projection dimension – free drawing – perspective drawing- threee dimensional modeling – modeling by computer engineering drawing tools – Engineering processes – engineering projection – perspective derivation- derivation of the third view – sectors – steel construction- mechinacl assembling-<br><br>Practical part:<br> Using Auto CAD program to do the following:<br>Drawing projections  - derivation of the third view – Drawing sectors – steel structures – point, lines, and plain projection - Projection Assistant  - Multi-Surfaces |

| Code | **UR 042** |
|---|---|
| **Field** | **College Requirements Eng** |
| **Title** | **English2** |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | **English1   UR 041** |
| **Description** | **Analysis and illustration of writing – reading subjects from the several sizes book- concentrated revision for the long writing which include research – experience in subjects presentation -** |

| Code | **CR 032** |
|---|---|
| **Field** | **College Requirements Eng** |
| **Title** | **Mechanical workshop** |
| **Credits** | 2 Hrs (1 lec + 1Lab) |
| **Prerequisite** | - |
| **Description** | **Engineering Materials: Ferrous and non-ferrous metals - Introduction to engineering Instruments - Metal forming and machining - Different methods of joining metals - Introduction to non-conventional machining.**<br><br>**Practical Part**<br>**Practical exercises in the workshops of: Carpentry, filings and blacksmithing, welding, plumbing and lathe machining** |

| Code | **ACE 090** |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Summer Training 1** |
| **Credits** | 1 Hrs |
| **Prerequisite** | - |
| **Description** | **Practical training in the faculty in the  Mechincal workshop (2 weeks) (Carpentry, filings and blacksmithing , welding, plumbing and lathe machining) and Engineering drawing (2 weeks). For  6Hr. Per day, 4 days per week  for 4 weeks,** |

# 2- Level 1
# First term

| Code | CR 106 |
|---|---|
| **Field** | College Requirements Eng |
| **Title** | Eng. Mathematics 1 |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | Mathematics 2 **CR 002** |
| **Description** | Partial differetiation applications - maximum value of functions in multivariables – vector analysis – vector differential operators – multiple integration and its application ( curvature and perpendicular coordinates – Gauss and Stoke's theorem) – infinite series and function expansion – Basic principles of divergence and convergence – ordinary first order differential equations- homogeneous equation- ordinary second order differential equation – constant coefficient equation complementary function and its special solution- Laplace transform and its application in differential equation solution |

| Code | CR 131 |
|---|---|
| **Field** | College Requirements Eng |
| **Title** | **Electronic circuits and components drawing using computer** |
| **Credits** | 3 Hrs (1 lec + 2Lab) |
| **Prerequisite** | Eng. Drawing **CR 031** |
| **Description** | Drafting techniques of electronic designs-Symbols of electronic Circuits drafting Assembly and detail drawing-Electronic-Components symbols – Schematic -diagram drawing-Wiring and printed circuit board diagrams-Draw Proper Schematic diagrams of pictorial diagrams-Computer-aided-drawing of electronic Components and circuits-Computer-aided-drawing of printed circuit boards. <br><br> **Practical Part:** <br> Use Agel, Express or Orcad program in carrying out the following: <br> Drawing electronic components and symbols - Electronic circuits diagram - printed circuit boards – Drawing of multi-layered circuits |

| Code | ACE  161 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Electrical Eng.** |
| **Credits** | 3 Hrs (2 lec + 1Tut ) |
| **Prerequisite** | **Mathematic2 CR 002** |
| **Description** | **Electrical circuit constants and variables - Electrical circuit elements – Simple resistance circuit - Electrical circuit analysis – Transformation between electrical sources – Electrical network theories – Delta and star connection and the transformation between them – Steady state sinusoidal AC current circuit – Time vector representation – Power and power factor – Resonance circuit – Inductive coupling Circuit – Three phase circuits.** |

| Code | CR 132 |
|---|---|
| **Field** | **College Requirements Eng** |
| **Title** | **Solid state physics** |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | **Physics2 CR 013** |
| **Description** | **Atomic structure – Quantum mechanics - principles  of crystal structure for solid materials – Energy bands and charge carriers – Carrier concentration and diversion in fields – Concentration of excess carrier in semiconductors- Optical absorption – Carrier interference – Insulating materials – Dielectric constant – Polarization – Piezoelectric – Dielectric losses – Magnetic materials properties – Ferrite materials – Magnetic effects of super conductors** |

| Code | ACE 171 |
|---|---|
| **Field** | **Specializatioedn Requirements** |
| **Title** | **Electronics 1** |
| **Credits** | 4 Hrs (2 lec + 1Tut + 1Lab) |
| **Prerequisite** | **Physics2 CR 013** |
| **Description** | **Semiconductor physics – Semiconductors – Diffusion current in pn- junction – Biasing of pn- junction – Different types of pn- junctions – Electron ballistics – Semiconductor diodes application – Zener diodes and other elements.**<br><br>**Practical part:**<br>**Measuring the properties of the p-n junction and its** |

| | |
|---|---|
| | **estimated resistance- properties of Zener diode –Halve wave rectifier – Full wave rectifier – diode limmeter – clipping circuit** |

| Code | CR 142 |
|---|---|
| **Field** | **University Requirements** |
| **Title** | **Environmental Eng.** |
| **Credits** | 2 Hrs (2 lec) |
| **Prerequisite** | - |
| **Description** | Air pollution and solution- radiation pollution- physical environment and pollution- purification of factories- exhaust gases and energy station's pollution- renewable energy sources- earth thermal energy- mobile telephone technology - environmental noise – Waste recycling |

# Second term

| Code | CR 107 |
|---|---|
| **Field** | **College Requirements Eng** |
| **Title** | **Eng. Mathematics 2** |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | **Eng. Mathematic 1 CR 106** |
| **Description** | Partial differentiation – Multiple integrals – Infinite series - Subjects in analytical geometry and conic sections – Parametric and polar equations – Fourier series – Fourier transforms – Z- transforms. |

| Code | ACE 172 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Electronics 2** |
| **Credits** | 4 Hrs (2 lec + 1Tut + 1Lab) |
| **Prerequisite** | **Electronics 1 ACE 171** |
| **Description** | Bipolar Junction Transistor fundamentals - Bipolar Junction Transistor Characteristics - Bipolar transistor Circuits - Small Signal Bipolar Transistor Equivalent Circuit - Single Stage Bipolar Transistor Amplifier – pn- junction Field Effect Transistor – Schottky Field Effect Transistor – Insulated – gate Field Effect Transistor - Field Effect Transistor equivalent circuit and biasing circuit. |

| | |
|---|---|
| | **Practical part:**<br>**Measuring the properties of bipolar transistor - Study methods of connection and transistor biasing - Bipolar Transistor Amplifier – Properties of pn- junction Field Effect Transistor– FET transistor biasing -- Field Effect Transistor amplifier** |

| Code | **ACE 173** |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Biochemistry** |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | **CR132** |
| **Description** | **This course covers the physio-chemical concepts and processes relevant to life. The emphasis lies on the molecular level. Topics: Biomimetics; Energy and Driving Forces; Biochemical Equilibria; Aqueous Solutions; Molecular Self-Assembly; Bio-Electrochemistry; Biopolymers; Molecular Recognition and Binding Equilibria in Biology.** |

| Code | **ACE 181** |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Anatomy** |
| **Credits** | 3 Hrs (1 lec + 2Lab) |
| **Prerequisite** | - |
| **Description** | **The study of the human body, introduction of anatomical terminology and an overview of cellular processes and tissueclassification.Learn the gross an d microscopic anatomy of the following systems: integumentary, skeletal, muscular, nervous, circulatory, respiratory, digestive, urinary, andreproductive.** |

| Code | **CSE151** |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Computer Programming 2** |
| **Credits** | 3 Hrs (2 lec + 1Lab) |
| **Prerequisite** | **Computer Programming 1 CSE051** |
| **Description** | **Basics of data structure- Algorithms and data types – Data structure – Scheduling – sorting - graphic- Algorithms (processing, arrangement, searching), all structure and programming are performed using C++ language - Tree analysis and algorithms design - Algorithms efficiency -** |

|  |  |
|---|---|
| Complex calculations – Parallel algorithms – Introduction to windows – Windows programming - basics of programming – Training on using one of the visual programming language as an example of windows programming. |  |

| Code | **UR 143** |
|---|---|
| Field | **University Requirements** |
| Title | **History of Eng. Sciences** |
| Credits | 2 Hrs (2 lec) |
| Prerequisite | - |
| Description | **History of Engineering Sciences in ancient centuries-Electronics history - Historical developments of Tv. broadcasting- History of transistor and Integrated Circuits invention- Electromagnetic waves discovery by Hertz and Marconi- efforts for radio broadcasting discovery.** |

| Code | **ACE  190** |
|---|---|
| Field | **Specialization Requirements** |
| Title | **Summer Training 2** |
| Credits | 1 Hrs |
| Prerequisite | **Summer Training 1 ACE  090** |
| Description | **Practical training in the faculty in electrical and Electronics workshops and lab, for  6Hrs. Per day, 4 days per week,  for 4 weeks** |

# 3- Level 2
# First term

| Code | CR 209 |
|---|---|
| Field | College Requirements Eng |
| Title | Signal Analysis |
| Credits | 3 Hrs (2 lec + 1Tut) |
| Prerequisite | Eng. Mathematics 2 CR 107 |
| Description | Analogue signal Analysis – Power spectrum- Energy spectrum signal presentation in time and frequency domain- Signals and systems- Signals presentation - Sampling- Constant linear system response- Frequency response- Discrete signals – Z-transform and inverse Z-transform- Non-continuous Fourier transform- Random process- Convolution and correlation- Spectrum transform. |

| Code | ACE 261 |
|---|---|
| Field | Specialization Requirements |
| Title | Electrical Circuits |
| Credits | 4 Hrs (2 lec + 1Tut + 1Lab) |
| Prerequisite | Electrical Eng.  ACE 161 |
| Description | Introduction to DC circuit analysis- Circuit theories- Maximum power transfer- Theories of AC analysis- Coupling circuits- Resonance circuits – Non linear circuit analysis.<br><br>**Practical part:**<br><br>Realization of Dc circuits – realization of circuit theory - Maximum power transfer- realization of AC circuits analysis-  Coupling circuits-  Properties of  Resonance circuits – Non linear circuit analysis.- |

| Code | ACE  274 |
|---|---|
| Field | Specialization Requirements |
| Title | Electrical safety |
| Credits | 4 Hrs (2 lec + 1Tut + 1Lab) |
| Prerequisite | ACE 172 |
| Description | Introduction to the types of hazards in hospitals and clinics, electrical hazards safety requirements of power distribution |

in hospitals, biological, safety codes and standards for biomedical equipments and facilities, test instruments for checking safety parameters of medical instruments.

**Practical part:**
Simplified electric-power distribution - Fuse panel - Isolated-power systems - Types of hazards in hospitals - Common types of faults in equipment - Safety codes - Testing equipments and instruments

| Code | ACE272 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Electrical Power and machines Eng.** |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | **Electrical Eng. ECE161** |
| **Description** | Three phase circuits – Transmission lines – Transmission lines current and voltage relations – Representation of power systems – Transformers – Induction motors (single and three phases) – Direct current machines |

| Code | CSE251 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Computer Eng.** |
| **Credits** | 3 Hrs (2 lec + 1Lab) |
| **Prerequisite** | **Computer Programming 2 CSE151** |
| **Description** | Logic design – Logic circuit - Memory elements – Counters – Registers – Analysis and design of combinational digital circuits – Analysis and design of sequential digital circuits- Invention and development of memory elements and processors- Evaluation of computer performance- Memory characteristics and hierarichy– Kinds of memory –Memory managements - Kinds of processors – Order cycle.<br><br>**Practical part:**<br>Realization of logic design for different circuits – realization of flip flop cicuits – realization of register – Realization of counter – realization for different sequential circuits |

| Code | UR 247 |
|---|---|
| **Field** | **University Requirements** |

| Title | Quality assurance standards |
|-------|------------------------------|
| Credits | 2 Hrs (2 lec) |
| Prerequisite | - |
| Description | Decision analysis- Linear programming- New methods for quality adaptation and improvement in the industrial services- General frame for overall quality system operation in relation with quality-quantity Functions and limits. |

# Second term

| Code | ECE264 |
|------|--------|
| Field | Specialization Requirements |
| Title | Electronic Circuits |
| Credits | 4 Hrs (2 lec + 1Tut + 1Lab) |
| Prerequisite | Electrical circuit ECE261 - Electronics2 ECE172 |
| Description | Multi stages amplifier – Feed back amplifier oscillators – Power amplifier- High frequency amplifiers - Integrated Circuit amplifiers – Wide band amplifier- Operational Amplifiers characteristics- Wave generation and shaping- Application of non-linear circuits- Design of analog electronic circuits- Circuit simulation- Response description and printed circuit building.<br><br>**Practical part:**<br>Characteristics of multi stage amplifier – Gain measurements – coupling - Characteristics of feedback amplifier – Oscillator characteristics – Power amplifier – High frequency amplifiers – IC amplifiers |

| Code | ECE 262 |
|------|---------|
| Field | Specialization Requirements |
| Title | Fields and waves |
| Credits | 3 Hrs (2 lec + 1Tut) |
| Prerequisite | Electrical circuit ACE 261 - Physics2 CR013 |
| Description | Electrostatic Fields- Electric flux and gauss's law- Electrical Potential – Electric boundary conditions – Dipole moment – Capacitance- Poisson and Laplace equations – Piot & savart law- Amperes law- Vector potentials- Magnetic boundary conditions- Magnetic flux – Force and energy in magnetic field- Coils – Time varying field- Maxwell's equations- Wave propagation – Introduction to transmission line theory- |

| | Propagation in losses and lossless media- Reflection and refraction. |
|---|---|

| Code | ACE  263 |
|---|---|
| Field | Specialization Requirements |
| Title | Physiology |
| Credits | 4 Hrs (2 lec + 1Tut + 1Lab) |
| Prerequisite | ACE 181 |
| Description | Introduction to quantitative modeling of physiological systems geared towards the Biomedical Engineering student. It will cover fundamental topics in physiology ranging from cell membrane models and chemical messengers to neuronal signaling and control of body movement. In addition, specific physiological systems are discussed in detail, including the cardiovascular, pulmonary, and visual systems. Furthermore, pharmacokinetic models provide quantitative assessment of the dynamics of drug distribution and compartmental interactions.<br><br>**Practical part:**<br>virtual physiology Lab for (cardiac physiology - peripheral circulation - neural receptor physiology - respiration - digestion -  fluid balance -  temperature regulation) |

| Code | ACE  281 |
|---|---|
| Field | Specialization Requirements |
| Title | Electrical Measurements |
| Credits | 3 Hrs (1 lec + 2Lab) |
| Prerequisite | Electrical circuit  ACE 261  Eelectronics2 ACE 172 |
| Description | Introduction to Measurement systems – Measurement errors – Attenuators – Direct and alternating current indicating instruments – DC bridges – AC bridges – Error detection in cables - Oscilloscopes.<br><br>**Practical part:**<br>Errors in Measurement and Basic Statistical Sampling - DC Current and Voltage Measurement - Resistor Characteristics and Ohms Law - Oscilloscope - Oscilloscope - Measurement Using DC Bridges - Measurement Using AC Bridges - Measurement of Semiconductor Devices with Multimeter - Thermistor Characteristics and Temperature |

| | |
|---|---|
| | **Controlled Circuits** |

| Code | **CR 208** |
|---|---|
| **Field** | **College Requirements Eng** |
| **Title** | **Probability theory and random variables** |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | **Eng. Mathematics 2 CR 105** |
| **Description** | **Measurements of convergence and divergence- Repetitive distributions- Continuous and discrete distributions - Sampling distributions - Hypothesis – Nonparametric tests- Correlation and non-correlation - Time-domain series analysis.** |

| Code | **ACE  282** |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Applied Project** |
| **Credits** | 2 Hrs (2 lec + 1Lab) |
| **Prerequisite** | - |
| **Description** | **A major independent project under the supervision of a staff member; to enable the student to understand and apply the knowledge gained throughout his coursework to an engineering problem at large scale.** |

| Code | **ACE  290** |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Summer Training 3** |
| **Credits** | 1 Hrs |
| **Prerequisite** | **Summer Training 2 ACE  190** |
| **Description** | **External training for 4 weeks in the work positions, factories and originations** |

# 4- Level 3
# First: Compulsory courses
# First term

| Code | ACE  387 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Intelligent control systems** |
| **Credits** | 3Hrs (2 lec + 1Lab) |
| **Prerequisite** | CR209 |
| **Description** | **Introduction to intelligent control systems - Fuzzy Set Theory Fuzzy Operations and Relations - Fuzzy Rule Based System - Design and Structure of Fuzzy Logic Control Systems - Types of Fuzzy Logic Control Systems - Some of Fuzzy Logic Control System Applications -Introduction to Neural networks - Biological and Artificial Models of Neural Networks - Neural Networks learning Rules - Back-Propagation Neural Networks - Neural Networks in Process Modeling and Control - Some of Neural Networks Applications.**<br><br>**Practical part:**<br>**Designing steps for Fuzzy Logic Control using MATLAB Modelling using Neural Networks using MATLAB** |

| Code | ACE  302 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Automatic control** |
| **Credits** | 4 Hrs (2 lec + 1Tut + 1Lab) |
| **Prerequisite** | ACE 272 |
| **Description** | **Introduction to programmable controllers (Conceptual design of the PLC & Principles of operation) - PLC Hardware (Processor - Power supply - Memory organization) - Programming devices - PLC programming Language (Ladder diagram)- Lab./Practical Applications.**<br><br>**Practical part:**<br>**Simple Ladder Logic Program Examples**<br>        **Simple Start/Stop Ladder Logic Relay**<br>        **Single Push Button On/Off Ladder Logic**<br>**Ladder Logic Examples with Timers** |

| | PLC Program Example with On Delay Timer<br>PLC Program Example with Off Delay Timer<br>PLC Program Example with Retentive Timer |
|---|---|

| Code | **ACE 375** |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Digital signal processing** |
| **Credits** | 3 Hrs (2 lec + 1Tut ) |
| **Prerequisite** | **CR** 209 |
| **Description** | **Introduction to discrete linear systems, Discrete-Time Fourier Transform and Linear Time Invariant Systems, the Z transform, Properties of digital filters , Fourier transforms, sampling, The discrete Fourier transform , The fast Fourier transform, Digital filter design.** |

| Code | **UR 347** |
|---|---|
| **Field** | **University Requirements** |
| **Title** | **Technical report writing** |
| **Credits** | 2 Hrs (1 lec + 1Tut) |
| **Prerequisite** | Language 2  UR 042 |
| **Description** | **Definition of Eng writing- identification of received students-eng. Writing process- Research- summary- page design-reports- web site design- comments- suggestion-user manual-oral report** |

# Second term

| Code | **ACE 311** |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Medical electronics** |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | **Signal Analysis CR209** |
| **Description** | **Fundamental knowledge of electronics. An overview of medical equipment used in the hospital and other medical environments to diagnose and treat patients. Sensors and physiological signals will be explained. Equipment found in various hospital departments and medical specialties will also be discussed. Patient safety and regulations will be emphasized.** |

| Code | ACE 385 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Introduction to Biomedical Optics** |
| **Credits** | 3 Hrs (2 lec + 1Tut) |
| **Prerequisite** | ACE 264 |
| **Description** | **Biomedical optics is an interdisciplinary subject of applying optical methods for diagnostic detection and manipulation of cells and tissues. This course aims to introduce fundamentals and frontier topics of biomedical optics. It includes three parts: fundamentals, optical probing of cellular processes, and manipulation of cells and tissues. The first part explains principles of lasers and current laser technology, interaction of light with cells and tissues, and linear and nonlinear optical spectroscopy. The second part discusses various optical probing methods including diagnostic detection with various spectroscopy techniques, bioimaging with optical microscopy and tomography, optical probes, microarray technology and nanotechnology in biophotonics. The third part includes topics in photodynamic therapy, tissue engineering with light, and laser tweezers** |

| Code | ACE 386 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Biomedical Imaging Systems** |
| **Credits** | 3Hrs (2 lec + 1Tut) |
| **Prerequisite** | ACE 264 |
| **Description** | **Basic concepts of matter-energy interaction.The atom and the electromagnetic radiation spectrum.Factors determining the diagnostic quality of the image. X-rays - generation, projectional radiography, fluoroscopy, computed tomography, tomographic principles and reconstruction, magnetic resonance - principles of magnetic resonance, positioning systems using gradients and excitation and reading sequences. Measurement of flux and others advanced properties using magnetic resonance. Ultrasonography - operating principles and methods of operation, the Doppler effect. Nuclear medicine - radioactivity and nuclear transformations, radiotracer production. Positron emission tomography and single photon emission computed tomography. Introduction to conventional and advanced optical microscopy techniques.** |

| Code | UR 345 |
|---|---|
| Field | University Requirements |
| Title | Human Rights |
| Credits | 2 Hrs (2 lec) |
| Prerequisite | - |
| Description | General view on human rights from the point of view of international laws- The Islamic legislation and human rights- the human rights resources and its public freedom in Europe and Egypt- the human rights in suitable environment. |

# Second: Elective Courses

| Code | ACE 328 |
|---|---|
| Field | Specialization Requirements |
| Title | Biomedical Image Processing |
| Credits | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| Prerequisite | CSE 151 |
| Description | This course will present the fundamental concepts of image formation, image segmentation and organ shape. This course will demonstrate students how to use the above tools in analyzing medical images. Design and visualization tools will include MATLAB, and other application software such as the ITK software. |

| Code | ACE 329 |
|---|---|
| Field | Specialization Requirements |
| Title | Artificial neural networks |
| Credits | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| Prerequisite | ACE 281 |
| Description | Neural Networks Basics - Mathematical models of Neural Networks - Neural Networks Topologies – Supervised learning- Unsupervised learning- Feature Extraction Methods – Feature selection Methods - Feature combination Methods - Learning and Training Algorithms - Momentum and Decreasing Errors – Over-Fitting and Cross-Verification Algorithms - Recall and Performance Estimation - Validation and Testing Algorithms - Neural Networks Implementation- Multilayer perceptrons- Genetic algorithms- Neural networks in microwave modeling- neural networks in communications- Neural networks in antennas- Support vector machines and applications. |

| Code | ACE 330 |
|------|---------|
| **Field** | **Specialization Requirements** |
| **Title** | **Computer Tomography** |
| **Credits** | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| **Prerequisite** | CSE 251 |
| **Description** | **This course covers the principles of 3D reconstruction from projections in medicine. The mathematics of reconstruction from projections is covered, followed by the application to X-ray, Magnetic Resonance Emission Tomography and Ultrasound.** |

| Code | ACE 331 |
|------|---------|
| **Field** | **Specialization Requirements** |
| **Title** | **Tissue Engineering** |
| **Credits** | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| **Prerequisite** | ACE 181 |
| **Description** | **Fundamentals of polymer scaffolds and their use in artificial tissues.Regulation of cell responses in the rational design and development of engineered replacement tissue. Understanding the biological, chemical and mechanical components of intra and intercellular communication. Preliminary discussions on real-life clinical experiences.** |

| Code | ACE 332 |
|------|---------|
| **Field** | **Specialization Requirements** |
| **Title** | **Modeling and simulation** |
| **Credits** | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| **Prerequisite** | **ACE 264** |
| **Description** | **Model definition- Performance Evaluation Techniques- Development of Systems Simulation- Designing and Implementing a Discrete-Event Simulation Framework- Monte Carlo Simulation- Network Modeling-The Network Modeling and Simulation Process-Network Simulation Packages- OPNET- Designing and Implementing CASiNO: A Network Simulation Framework-Statistical Distributions and Random Number Generation-Queuing Theory- Input Modeling and Output Analysis- Modeling Network Traffic-** |

| | |
|---|---|
| | Optimization techniques- particle swarm optimization- genetic algorithms. |

| Code | ACE 333 |
|---|---|
| Field | Specialization Requirements |
| Title | VLSI Technology |
| Credits | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| Prerequisite | ACE 264 |
| Description | Introduction – MOS transistor theory  modeling of transistor using  SPICE – fabrication of integreted circuits -Inverter static characteristics  - Inverter dynamic  characteristics – Combinational  MOS logic  - Sequential MOS  logic circuits - MOS semiconductor  Memories - Description  component and analysis – Interaction with matter Ion Implementation . |

| Code | ACE 334 |
|---|---|
| Field | Specialization Requirements |
| Title | Nano Devices |
| Credits | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| Prerequisite | CR 132 |
| Description | Introduction.- Microscopic Classical Theory.- Quantum Theory with Classical Fields.- Quantum Electrodynamic TheoryNanophotonics- Dressed photon technology for qualitatively innovative optical devices, fabrication, and systems- DNA process for quantum dot chain- Photon enhanced emission microscopy.- Nearfield spectroscopy of metallic nanostructure.- Self-organized fabrication of composite semiconductor quantum dots- Metallic nanostructure- Nanophotonic information systems with security – Single electron transistor- Nano-optics- Nano antennas- Nano acoustics- CAD techniques for nano devices design. |

| Code | ACE 335 |
|---|---|
| Field | Specialization Requirements |
| Title | Programmable Logic Controllers |
| Credits | 3 Hrs ( 2 lec + - Tut + 3 Lab ) |
| Prerequisite | ACE 272 |

| Description | The Analog Input/Output System - Special Function I/O - GRFCET Programming - Local Area Networks - Serial Communications - I/O Bus Networks - PLC Maintenance - System Selection Guidelines - Application Examples<br><br>**Practical part:**<br>**Ladder Diagram for Motor Control**<br>     **Star Delta PLC Ladder Diagram**<br>     **Ladder Diagram for DOL Motor Starter**<br>**PLC Program Examples From The Real World**<br>     **Traffic Light Ladder Logic Diagram**<br>     **Ladder Diagram for Bottle Filling Plant**<br>**PLC Ladder Diagram for Elevator Control** |
|---|---|

| Code | **ACE 336** |
|---|---|
| Field | **Specialization Requirements** |
| Title | **Real Time Control Systems** |
| Credits | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| Prerequisite | ACE 272 |
| Description | **Introduction to Real Time Systems - Types of real time systems - Computer concepts for industrial process - Real time control system requirements - Sequential and supervisory control -Soft ware requirements - Real time operating systems - Embedded real time operating system - Hardware requirements – Interfacing - Direct digital control systems - Application of DDC in real time - Algorithm real** |

| Code | **ACE 337** |
|---|---|
| Field | **Specialization Requirements** |
| Title | **Biofluid mechanics** |
| Credits | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| Prerequisite | ACE 173 |
| Description | **This course introduces the fundamentals of biofluid dynamics and continuum mechanics, and covers the application of these principles to a variety of biological flows. Fluid flow in physiology and biotechnology is investigated at a variety of scales, ranging from subcellular to full body.** |

| Code | **ACE 338** |
|---|---|
| Field | **Specialization Requirements** |

| Title | Organic chemistry |
|---|---|
| Credits | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| Prerequisite | CR  021 |
| Description | Introduction to organic chemistry; how to study and learn organic chemistry: see Forward, Contents, P reface, and Prologue to Smith text.  Review of general chemistry: bonding, acid - base chemistry; equilibrium expressions Lewis structures, molecular shapes; line- angle formulas for organic molecules, nomenclature.  Acids and bases; organic acids and conjugate bases . Introduction to organic functional groups and their chemistrie. Alkanes, conformations of ethane, butane, and cyclohexanes; oxidation of alkanes.Stereochemistry; enantiomers, R and S configurations; diastereomers .Introduction to organic reactions, including appropriate use of thermodynamic functions, energy diagrams, and rate expressions.Introduction to spectroscopic identification of organic compounds. |

| Code | ACE 339 |
|---|---|
| Field | Specialization Requirements |
| Title | Random processes |
| Credits | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| Prerequisite | CR 208 |
| Description | Basic Probability, Expectation and Variance, Conditional Probability, Law of Large Numbers and Convergence of Random Variables, Central Limit Theorem and Characteristic Functions, Simple Random Walk and Branching Processes, Martingales and Conditional Expectation, Markov Chains. |

| Code | ACE 340 |
|---|---|
| Field | Specialization Requirements |
| Title | Biostatistics |
| Credits | 3 Hrs ( 2 lec + 2 Tut + - Lab ) |
| Prerequisite | CR 107 |
| Description | In this introductory statistics course we will explore the use of statistical methodology in designing, analyzing, interpreting, and presenting biological experiments and observations. We will cover descriptive statistics, elements of experimental design, probability, hypothesis testing and |

| | statistical inference, analysis of variance, correlation, regression techniques, and non-parametric statistical methods. Throughout the course the application of statistical techniques within a biological context will be emphasized, using data from laboratory and field studies. |
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# 5- Level 4
# First: Compulsory courses
# First term

| Code | UR 446 |
|---|---|
| Field | University Requirements |
| Title | Engineering Economics |
| Credits | 2 Hrs (2 lec) |
| Prerequisite | - |
| Description | Introduction to economics- Demand and presentation of contents – costs – time value for money – money transfer-compression among substitutes- economic benefit- economic analysis of projects in the general work section – functional coding. |

| Code | ACE  478 |
|---|---|
| Field | Specialization Requirements |
| Title | mechatronics |
| Credits | 3Hrs (2 lec + 1Lab) |
| Prerequisite | CR 004 |
| Description | Interface circuitry, Microcontroller: physical hardware overview and limitations, Communications, Introduction to Mechatronics: definition of mechatronics, mechatronic design approach, sensors and actuators in mechatronic systems, system models, mechanical components, review on electrical components and magnetisms, component matching and performance specifications, Sensors: potentiometers; variable-inductance transducers, piezoelectric transducers; fiber optic sensors; laser interferometers; laser photoelectric sensors; ultrasonic sensors; linear variable differential transformers (LVDT); digital optical encoders; fiber optics; hall effect sensors; digital sensors, electric motors (D C, stepper, brushless and AC), servo motors, hydraulics, pneumatics, solenoid, voice-coil, etc.<br><br>Practical part:<br>Modeling and Actuation - Robotics - Control - Signal Processing - and Analysis and Optimization |

| Code | ACE 431 |
|---|---|
| Field | Specialization Requirements |
| Title | Biomedical Instrumentation |
| Credits | 3Hrs (2 lec + 1Tut) |
| Prerequisite | ACE263 |
| Description | The goal is to introduce biological systems and apply engineering principles (electrical and mechanical) to the solution of the biomedical problems. Special problems and requirements for recording and analyzing biological signals, i.e. ECG, EMG, from human subjects.The design of instrumentation amplifiers for analog signal conditioning. Examination of possible health hazards associated with measurement of biological signals. Study of relevant physiology and anatomy of the physiological systems.Analysis of biological signals. |

# Second term

| Code | UR 448 |
|---|---|
| Field | University Requirements |
| Title | Projects management |
| Credits | 2 Hrs (2 lec) |
| Prerequisite | - |
| Description | Fundamental definitions and illustrating skills for the influencing descions in projects management- planning and organization of a project in variable and complex work environments throughout technology tools- Typical examples that join theoretical and practical study cases |

| Code | ACE 420 |
|---|---|
| Field | Specialization Requirements |
| Title | Microcontrollers and Embedded Systems |
| Credits | 3Hrs (2 lec + 1Tut) |
| Prerequisite | ACE 264 |
| Description | Embedded Systems and microcontrollers, Microcontroller based systems IO capabilities of microcontrollers. Advanced programming on microcontrollers assembly and C. Study |

| | |
|---|---|
| | cases for microcontrollers controlled systems. Simulation and Emulation of specific families. |

| Code | ACE 484 |
|---|---|
| Field | Specialization Requirements |
| Title | Electrophysiological measurements |
| Credits | 3 Hrs (2 lec + 1Tut ) |
| Prerequisite | ACE 311 |
| Description | Basic components of a biomedical system – Electrodes – Micro, needle and Surface electrodes – Amplifiers – Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier. ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms. |

| Code | ACE 480 |
|---|---|
| Field | Specialization Requirements |
| Title | Graduation Project |
| Credits | 4 Hrs (1 lec + 3 Lab) |
| Prerequisite | 140 Credits |
| Description | A major independent project under the supervision of a staff member; to enable the student to understand and apply the knowledge gained throughout his coursework to an engineering problem at large scale- at the end of the project, the student should submit a report |

# Second: Elective Courses

| Code | ACE 441 |
|---|---|
| Field | Specialization Requirements |
| Title | Advanced Biomedical Image processing |
| Credits | 3 Hrs ( 2 lec + 2 Tut ) |
| Prerequisite | ACE 375 |
| Description | Methodology: concepts and algorithms, measures of similarity for coregistration of two or several various images, coregistration based on points or intensities, rigid coregistration, optimization methods, quantification of |

errors, application of multimodal coregistration (PET/MR/CT), coregistration in nuclear medicine. Non-rigid coregistration: parametric and non-parametric methods, multiresolution methods. Image matching: methods (variational, multiresolution, fuzzy), visualisation.

| Code | ACE 442 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Pattern Recognition in Machines & Bio. Systems** |
| **Credits** | 3 Hrs ( 2 lec + 2 Tu ) |
| **Prerequisite** | ACE 387 |
| **Description** | **This course will cover principles of pattern recognition in the visual system within the context of information processing in living organisms and computers. Topics include pattern formation, interpretation, and classification: computer vision compared to biological vision.** |

| Code | ACE 443 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Design of Assistive Devices** |
| **Credits** | 3 Hrs ( 2 lec + 2 Tut ) |
| **Prerequisite** | ACE 375 |
| **Description** | **Overview of assistive devices and design; Actuator, sensor and computer technology; Human-machine interface and control; Human factors; Clinical considerations.** |

| Code | ACE 444 |
|---|---|
| **Field** | **Specialization Requirements** |
| **Title** | **Clinical Engineering** |
| **Credits** | 3 Hrs ( 2 lec + 2 Tut ) |
| **Prerequisite** | ACE 311 |
| **Description** | **To introduce Clinical Engineering to the (electrical) engineering students. Health-Care Delivery Systems: Organization, Economics, Codes & Standards, Information Flow and Handling, The Clinical Engineering Program, The Safety Program, Equipments: Acquisition, Control Program, Maintenance, Legal & Ethical Aspects.** |

| Code | ACE 445 |
|---|---|
| Field | Specialization Requirements |
| Title | Biomechanics |
| Credits | 3 Hrs ( 2 lec + 2 Tut ) |
| Prerequisite | CR 004 |
| Description | Introduction to mechanicalfunctions of human body; skeletal adaptations to optimize load transfer, mobility, and function. Dynamics and kinematics.Fluid mechanics applications. Heat and mass transfer. Powergeneration. Laboratory simulations and tests. |

| Code | ACE 446 |
|---|---|
| Field | Specialization Requirements |
| Title | Kinetics and Thermodynamics of Biological Systems |
| Credits | 3 Hrs ( 2 lec + 2 Tut) |
| Prerequisite | ACE 181 |
| Description | Fundamentals of thermodynamics and kinetic analysis as applied to biomedical systems and technologies. Essential principles in thermodynamics will be introduced, including First Law, Second Law, and interrelationships among thermodynamic variables. Fundamental tools in kinetic analysis are also covered, including interpretation of rate data, enzyme kinetics, and pharmacokinetics. Application to biological systems and biomedical technologies are provided. |

| Code | ACE 447 |
|---|---|
| Field | Specialization Requirements |
| Title | Renewable energy |
| Credits | 3 Hrs ( 2 lec + 2 Tut ) |
| Prerequisite | ACE 172 |
| Description | Introduction to renewable energy - Renewable energy implementation - Main elements in renewable energy - Control of renewable energy. |

| Code | ACE 448 |
|---|---|
| Field | Specialization Requirements |
| Title | Telemedicine |
| Credits | 3 Hrs ( 2 lec + 2 Tut ) |
| Prerequisite | ACE 281 |

| Description | History of telemedicine, Block diagram of telemedicine system, Definition of telemedicine, Tele health, Tele care, organs of telemedicine- Type of information, type of communications and network, Types of antennas depending on requirements, Data Exchange: Video Conferencing. Data Security and Standards.Ethical and legal aspects of Telemedicine. Tele radiology: And tele catriology Teleoncology, Telesurgery. - Applications of Telesurgey. |
|---|---|

| Code | **ACE 449** |
|---|---|
| Field | **Specialization Requirements** |
| Title | **Nuclear medicine** |
| Credits | 3 Hrs ( 2 lec + 2 Tut ) |
| Prerequisite | ACE 386 |
| Description | **Introduction, The Role of Imaging in Nuclear Medicine: The Medical Perspective, Physics of Imaging in Nuclear Medicine, Tomographic and Hybrid Imaging in Nuclear Medicine, Perspectives in Nuclear Medicine Tomography: A Physicist's Point of View.** |