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# Al-Furat Al-Awsat Technical University

## Engineering Technical College-Najaf

### Description of courses

# Avionics Engineering Techniques Department

Prepared by: Staff of the Avionics Engineering  
Techniques Department

2022/2023

## Academic description of the Avionics Engineering Techniques Department

- 1- Ministry: Ministry of Higher Education and Scientific Research.
- 2- University: Al-Furat Al-Awsat Technical University- Engineering Technical College-Najaf.
- 3- Department: Avionics Engineering Techniques Department.
- 4- Final Degree: Bachelor of Avionics Engineering.
- 5- School system: Yearly.
- 6- Accredited accreditation program: ABET.
- 7- Other External Indicators:
- 8- Date of preparation: Sep 10, 2022.
- 9- Vision: The vision of the Avionics Techniques Engineering Department at the Engineering Technical College - Najaf is to provide the community with technical engineers in the field of electronics engineering in general and Avionics in particular with a high level of competence, dedication and moral responsibility.
- 10- Message:

The mission of the Avionics Techniques Engineering Department at the Najaf Technical College of Engineering is:

  - Serving our students by teaching them how to deal with problems and find appropriate solutions, linking theory and practice, leadership skills and teamwork, the value of commitment and ethical behavior, and respect for others.
  - Providing graduates of technical engineers with a high academic level and broad practical skills in the field of specialization.
  - Providing innovative technology for the benefit of society locally and globally in the field of specialization.
  - Providing modern research to solve problems and develop the performance of electronic and electrical systems and control systems in the field of aviation.
  - Cooperating with civil and military bodies to market the skills of the field of specialization.
  - Providing advice on obtaining a civil aviation license, an air service training license from the European Aviation Safety Agency, and licenses for ground support...etc.
- 11- Goals:

Due to the rapid scientific and technological progress in the field of aviation technology, the Avionics Techniques Engineering Department works to achieve clear strategic goals that help it achieve a prominent position within academic communities, which are evident in the following:

  - 1- Maintaining and improving the quality of the curriculum through:
    - Introducing scientifically and internationally updated study materials in the study of the specialty of avionics technology and keeping pace with rapid scientific development through direct contact with decision-makers for aircraft engineering in all parts of the world and direct contact with colleges and institutes specialized in aviation technology.
    - Continuous evaluation and development of curricula.
    - Linking student projects and research to community needs.
    - Expanding student awareness through field visits to domestic airports, seminars, and training on airport runways and maintenance workshops.
  - 2- Developing scientific laboratories, providing them with the latest technical equipment and equipment in the field of specialization, and managing them through a group of skilled technicians.
  - 3- Providing the best university environment for the teaching staff.
  - 4- Maintaining the technical development of faculty members through:
    - Encouraging active participation in conferences and technical meetings, especially with Iraqi and international airport administrations and international training companies.
    - Continuous review and evaluation of their activities.
    - Encouraging faculty initiatives and achievements.

- 5- Knowledge production through:
  - Conducting distinguished theoretical and applied research.
  - Encouraging scientific publishing and stimulating the collective work of research groups in various disciplines.
  - Striving to increase sources of research funding through publishing in international engineering journals.
- 6- Initiatives to reduce administrative routine and facilitate work procedures through educational guidance and developing the relationship between students and teachers.
- 7- Activating and strengthening links with public government agencies and the private sector through:
  - Organizing conferences, seminars and educational courses.
  - Encouraging consulting work and providing services at the professional level in all engineering specialties.
- 12- Required learning outcomes and teaching, learning and assessment methods
  - A- Knowledge and understanding
    1. The ability to apply knowledge in mathematics, science, and engineering.
    2. Understanding the professional and ethical responsibilities of the field of specialization.
    3. The ability to evaluate the course outcomes with faculty, industrial and professional practitioners, as well as employers and graduate students to improve them.
    4. Teaching leadership skills, the value of commitment, ethical behavior, and respect for others.
  - B- Subject-specific skills
    1. The ability to work and integrate into multidisciplinary teams.
    2. The ability to design and conduct experiments as well as analyze and interpret data.
    3. The ability to use modern technologies, engineering skills and tools to practice engineering.
    4. The ability to identify and formulate engineering problems in the field of specialization.
  - C- Thinking skills
    1. The ability to communicate effectively with those concerned with the field of specialization on both the civil and military sides.
    2. Recognizing the need and ability to engage in lifelong learning.
    3. Knowledge of contemporary issues in the field of specialization.
    4. The broad learning necessary to understand the impact of engineering solutions on global economic, environmental and social problems.
  - D- General and transferable skills (other skills related to employability and personal development)
    1. The ability to manage and work on ground and air support equipment for aircraft.
    2. The ability to electronic design of electronic systems and control and control devices using the latest design and simulation programs, which is a process to meet the required needs within the field of specialization in a realistic framework in which environmental, economic, social, political and health restrictions are imposed.
- 13- Planning for personal development  
The faculty members consist of a sufficient number, knowing that competence has a role to cover all curricula for the department's fields, in addition to the ability to manage the college adequately to accommodate levels of interaction, student guidance, counseling, university, professional and development services activities, and interaction with industrial and professional practitioners as well as employers.
- 14- Acceptance standard (setting regulations related to admission to the department)  
The desire of students to apply for admission to the Avionics Technology Engineering Department is the main criterion that will be taken into consideration at the Engineering Technical College - Najaf by filling out the department selection form that is given to new students accepted into the college. In addition, the applicant's average for joining the department will be taken into consideration.
- 15- The most important sources of information: University of Technology in Baghdad

- A. The American Academic Accreditation Board (ABET).  
B. American Institute of Aeronautics and Astronautics (AIAA)  
C. T- IEEE International Organization of Electrical and Electronic Engineers  
D. International Civil Aviation Organization (ICAO).
- 16- Career opportunities for graduates:  
The department's graduates work in a large number of industrial and service fields in the country and abroad, including, for example:
- Airline companies, example (Iraqi Airways)
  - Air Force and Air Defense institutions
  - The Iraqi Civil Aviation Authority
  - Iraqi and international aircraft maintenance companies
  - Local and international airports
  - Terrestrial and satellite communications centers
- 17- Admission inputs:
- Graduates of the scientific branch of preparatory study.
  - Graduates of the aviation or avionics department from Technical Education Authority institutes.
- 18- Admission outcomes:  
The duration of study in the Avionics Technology Engineering Department is four years, and the graduate is awarded a bachelor's degree in the field of Avionics Technology Engineering. He can complete postgraduate studies inside and outside the country in the field of Avionics Engineering or related and related specializations.
- 19- Teaching staff:  
Avionics technology engineering sciences are interconnected with some other engineering disciplines such as:
- Electrical Engineering
  - Electronic and communications engineering
  - Computer Engineering
  - mechanical engineering
  - Refrigeration and air conditioning engineering
  - Production and metallurgy engineering
  - Chemical Engineering
  - Space engineering
  - Energy engineering
- Because the Technical College of Engineering has professors in the above specializations with academic qualifications and long scientific experience on permanent staff, they have sufficient ability to achieve the outcomes of the academic program in an optimal manner.
- 20- Certificate awarded:  
The department grants graduates a technical bachelor's degree in avionics engineering.
- 21- Learning and teaching methods: lecture, workshop, laboratory, systematic teaching, summer training
- 22- Evaluation methods: oral exams, written exams, semester exams, final exams, daily evaluation
- 23- Corresponding departments in international universities:  
There is a Department of Avionics Technology Engineering in a number of international universities in various countries of the world, including:
1. Avionics department/ University of Science and Technology/Pakistan  
(<http://www.nust.edu.pk/INSTITUTIONS/Colleges/CAE/Departments/Avionics%20Engineering%20Department/Pages/default.aspx>).
  2. Program of Avionics/Southern Illinois University/USA.  
(<http://aviation.siu.edu/technologies/program-information/degree-specializations/avionics.php>).

3. Avionics Department/ Educational and Scientific Institute of Air Navigation/Ukraine. (<http://ian.nau.edu.ua/en/kafedra-avioniki/>)
4. Avionics Department Center/ OHIO University/USA  
(<https://www.ohio.edu/engineering/avionics/>)
5. Department of Avionics Engineering/Air University/Pakistan  
([http://www.au.edu.pk/dept\\_avi\\_intro.aspx](http://www.au.edu.pk/dept_avi_intro.aspx)).
6. Avionics department/Hindustan Institute of Technologies and Science/Indian  
(<http://hindustanuniv.ac.in/>).

First Years							
Sl. No.	Code	Course Type	Course Title	L	P	T	C
1	AVTE 111	Core	Electrical Circuits Analysis (AC&DC)	3	2	5	8
2	AVTE 112	Core	Engineering Physics & Electronic	3	2	5	8
3	AVTE 131	Core	Mechanics (Statics & Dynamic)	2	0	2	4
4	CREQ 141	Secondary	Eng. Drawing & Descriptive Geometry	0	3	3	3
5	CREQ 142	Secondary	Programming I	1	2	3	4
6	CREQ 143	Secondary	Workshop	0	6	6	6
7	MATH 151	Secondary	Mathematics-I	3	0	3	6
8	UREQ 161	General	Human Right & Democracy	2	0	2	4
9	UREQ 162	General	Environment	1	0	1	-
10	UREQ 163	General	English	1	0	1	-
Total				16	15	31	43
The percentage of core hours = 40%				The percentage of theory hours = 52%			
The percentage of Secondary hours = 48%				The percentage of practical hours = 48%			
The percentage of general hours = 12%							

Second Year							
Sl. No.	Code	Course Type	Course Title	L	P	T	C
1	AVTE 213	Core	Digital Systems - Basics & Applications Logic	2	3	5	6
2	AVTE 214	Core	Electronic Circuits & Electrical Machine	2	3	5	6
3	AVTE 215	Core	Aircrafts Structure & Aerospace Technology	2	2	4	6
4	AVTE 221	Core	Electromagnetic Field Theory	2	2	4	6
5	AVTE 232	Core	Thermodynamics of Propulsion Applied Aerodynamics-Basics	2	0	2	4
6	CREQ 245	Core	Training	-	-	-	-
7	AVTE 222	Secondary	Probability, Signals & Systems	2	2	4	6
8	MATH 252	Secondary	Mathematics II	3	0	3	6
9	CREQ 244	Secondary	Programming II	1	2	3	4
Total				16	14	30	44
The perce. of core hours = 67%				The perce. of theoretical hours = 53%			
The perce. of secondary hours = 33%				The perce. of practical hours = 47%			

Third Year							
Sl. No.	Code	Course Type	Course Title	L	P	T	C
1	6AVTE 31	Core	Microprocessors & Microcontroller	2	3	5	6
2	AVTE 317	Core	Airplane aerodynamics-Stability & Control., Avionics Navigation System.	2	2	4	6
3	AVTE 323	Core	Antenna & Transmission Lines	2	0	2	4
4	AVTE 324	Core	Analogy & Digital Communications.	2	3	5	6
5	CREQ 347	Core	Training	-	-	-	-
6	AVTE 325	Secondary	Digital Signal Processing	2	3	5	6
7	CREQ 346	Secondary	Engineering and Numerical Analysis.	3	0	3	6
8	AVTE 318	Secondary	Analog and Digital Control	2	3	5	6
9	UREQ 364	General	Air craft maintenances I	1	0	1	2
Total				16	14	30	42
The perce. of core hours =54%				The perce. of theoretical hours =53%			
The perce. of secondary hours = 43%				The perce. of practical hours =47%			
The perce. of general hours = 3%							

Fourth Year							
Sl. No.	Code	Course Type	Course Title	L	P	T	C
1	AVTE 4110	Core	Avionics System Design & Instruments	2	2	4	6
2	AVTE 4111	Core	Analog& Digital Integrated Circuits FPGA-Based System Design	2	2	4	6
3	AVTE 4112	Core	Aircraft Radar and Microwave	2	2	4	6
4	AVTE 426	Core	Aircraft Data Networking	2	2	4	6
5	CREQ 448	Core	Final Project	0	6	6	6
6	AVTE 419	Core	Power Electronics	2	2	4	6
7	CREQ 449	Secondary	Industrial Engineering	2	0	2	4
8	UREQ 465	General	Air craft maintenances II	2	0	2	4
Total				14	16	30	44
The perce. of core hours = 87%				The perce. of theoretical hours = 47%			
The perce. of secondary hours = 7%				The perce. of practical hours = 53%			
The perce. of general hours= 6%							

Stage	Subjects	Credit	Total H.W.	Theoretical H/W	Pract. H.W.	Core H.W.	Seco. H.W.	Gen. H.W.
First	10	45	31	16	15	13	15	4
Second	9	44	30	16	14	20	10	-
Third	9	42	30	16	14	16	13	1
Fourth	8	44	30	14	16	26	2	2
Total	<b>36</b>	<b>175</b>	<b>121</b>	<b>62</b>	<b>59</b>	<b>75</b>	<b>40</b>	<b>7</b>



Sl. No.	Code	Course Type	Course Title	L*	P*	T*	C*
1	AVTE 111	Core	Electrical Circuits Analysis (AC&DC)	3	2	5	8
2	AVTE 112	Core	Engineering Physics & Electronic	3	2	5	8
3	AVTE 131	Core	Mechanics (Statics & Dynamic)	2	0	2	6
4	CREQ 141	Secondary	Eng. Drawing & Descriptive Geometry	0	3	3	3
5	CREQ 142	Secondary	Programming I	1	2	3	4
6	CREQ 143	Secondary	Workshop	0	6	6	6
7	MATH 151	Secondary	Mathematics-I	3	0	3	6
8	UREQ 161	General	Human Right & Democracy	2	0	2	4
9	UREQ 162	General	Environment	1	0	1	-
10	UREQ 163	General	English	1	0	1	-
Total				16	15	31	45
%40The percentage of core hours = %48The percentage of Secondary hours = %12The percentage of general hours =				% 52The percentage of theory hours = %48 The percentage of practical hours =			

\*L is (theoretical hours), P is (practical hours), T is (total hours), C is (credit)

<b>Subject Number: AVTE 111</b>	
<b>Subject : Electrical Circuits Analysis (AC&amp;DC)</b>	
<b>L T P C</b>	
<b>3 0 2 8</b>	
Objective of the course: To provide an introduction to the fundamentals of circuits analysis with emphasis on fundamental quantities and components of electricity, basic electricity laws and network theorems.	
<b>Theoretical syllabus</b>	
<b>Week</b>	<b>Contents</b>
<b>1-2</b>	<b>Introduction to D.C circuits</b> Elect. Quantities - Charge - Elect. Force - Conductors and insulators - Current - Elect. potential and voltage - Energy and power- Efficiency
<b>3- 4</b>	<b>Fundamentals of electrical circuits</b> Resistance & resistivity - conductance & conductivity - Effect of temp. on resistance - Sources (voltage & current sources) - Ohms law - Circuits.
<b>5-7</b>	<b>Principles of electrical circuits</b> - Series circuits - Voltage divider rule - Voltage rule in the series - Parallel circuits - Current divider rule - Current source in parallel - Source transformation - Short & open circuit analysis of series-parallel networks - Kirchhoffs laws -
<b>8 -10</b>	<b>Method of analysis and network theorems</b> Branch current method - Mesh analysis - Nodal analysis - Star-delta and delta-star conversion - Superposition theory - Thevenins theorem - Maximum transfer theorem
<b>11-12</b>	<b>Capacitor and inductors</b> - Electric field - Capacitance - Capacitors in series and parallel - Faradays law - Lenzs law - Self inductance - Inductors in sires and parallel - Self inductance - Inductors in sires and parallel
<b>13 - 14</b>	<b>Magnetic circuits</b> - Magnetic field - Flux density - Permeability - Reluctance flux magneto motive force - Series magnetic circuits - Series-parallel magnetic circuits
<b>15 - 17</b>	<b>A.C. fundamentals</b> - Generation of alternating voltage and current - Equations of the alternation voltage and current - Average value - Effective(RMS) value - Series A.C. circuits - Parallel A.C. circuits - Series parallel A.C. circuits
<b>18 - 19</b>	<b>A.C. power</b> - Instantaneous - Average power - Complex power - Real power and reactive power - Apparent power - Power factor - Power factor correction
<b>20 - 21</b>	<b>Resonance</b> Series resonance - Quality factor - Selectivity - Bandwidth - Parallel resonance.
<b>22 - 25</b>	<b>3-Phase system</b> -3-phase generation - phase sequence - Inter connection of 3-phase - Star and delta connections - The Y-Y, Y-delta, delta-delta system - Power in 3-phase system
<b>26 - 28</b>	<b>Two-port network</b> Introduction - Terminal equations - Two-port parameters(z, y, h and ABCD), Equivalent circuits, Interconnected two-port.
<b>29 - 30</b>	<b>Electric transients (classical method)</b> The natural and forced response of series and parallel circuits - Circuits with zero and non zero initial conditions.
<b>Practical syllabus</b>	
<b>1</b>	Studying the working manner in the lab, the devices using and report writing.
<b>2</b>	Understanding the using of AC and DC voltage measurements device, AD and DC

	current measurements devices, resistance measurements devices.
3	Ohms' Law
4	Parallel and series resistance connections
5	Star and delta connections
6	Kirchhoff laws
7	Thevenins and Norton theories
8	Superposition theory
9	Substituting theorem
10	Maximum power transfer theory
11	Oscilloscope devices, comparison between maximum, effective, and average values. Calculation the peak and r.m.s. values
12	Series RL circuit and series RC circuit
13	Parallel RL circuit and parallel RC circuit
14	Measurement of polar angle for series and parallel RLC circuits.
15	Series and parallel resonance
16	Transfer maximum power in the AC circuit
17	Power and power factor measurements using Wattmeter.
18	Enhancement of power factor
19	Voltage and current in the three phase circuits connected in star and delta
20	Time constant of RL and RC circuits

**Recommended Books:**

## Text Books:

- Engineering Circuit Analysis by Willian Hayt & Kemmerly.

## Reference Books:

- Engineering Circuit Analysis by James W. Nilsson.
- Introduction to Electric Circuits by Richard C. Dorf.

**Subject Number: AVTE 112****Subject : Engineering Physics & Electronic**

L T P C

3 0 2 8

## Objectives of Course:

To review the fundamental concepts of physics to form basis for engineering subjects taught subsequently. In additive, the concepts of electronic are reviewed as an application of physics in electrical engineering.

**Theoretical syllabus**

Week	Contents
1	<b>Introduction to Physics</b> Units - Dimensional analysis - Experimental error
2 - 3	<b>Motion</b> Newton's laws of motion and their applications - Circular motion and gravitation - Work and energy - Impulse and Momentum - Rotational motion - Equilibrium of rigid body - Periodic motion.
4 - 5	<b>Properties of Matter</b> Elasticity – Types of module of elasticity – Stress-Strain diagram – Young's modulus of elasticity – Rigidity modulus – Bulk modulus – Factors affecting elasticity – Twisting couple on a wire – Tensional pendulum – Determination of rigidity modulus of a wire – depression of a cantilever – Young's modulus by cantilever – Uniform and non-uniform bending - Viscosity – Ostwald's viscometer – Comparison of viscosities.
6 - 7	<b>Acoustics and Ultrasonics</b> Classification of sound – Characteristics of musical sound – Intensity - loudness – Weber Fechner law – Decibel – Reverberation – Reverberation time - Derivation of Sabine's formula for reverberation time(Jaeger's method) – Absorption coefficient and its determination – Factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - Production – Magnetostriction and Piezoelectric methods – Properties – Applications of ultrasonics with particular reference to detection of flaws in metal ( Non – Destructive testing NDT) – SONAR.
8 - 10	<b>Crystal Physics, Non- Destructive Testing, Modern Engineering Materials and Superconducting Materials</b> Crystal Physics: Lattice – Unit cell - Bravais lattice – Lattice planes – Miller indices – $d$ spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – coordination number – Packing factor for SC, BCC, FCC and HCP structures. Non Destructive Testing: Liquid penetrate method – Ultrasonic flaw detection – ultrasonic flaw detector (block diagram) – X-ray Radiography – Merits and Demerits of each method. Modern Engineering Materials: Metallic glasses: Preparation properties and applications. Shape memory alloys (SMA): Characteristics, applications, advantages and disadvantages of SMA. Nano Materials: Synthesis – Properties and applications. Superconducting Materials: Superconducting phenomena – Properties of superconductors – Meissner effect – Type I and Type II superconductors – High Tc superconductors (qualitative) – uses of superconductors.
11-16	<b>Semiconductors</b> Atoms, Molecules and Solids - Combination of atoms - Bonding force in solids - Si and Ge crystals and other semi conductor materials - Energy bands in solids - Direct and indirect semiconductors - Effective mass of electron and hole. Intrinsic and extrinsic semiconductors - Energy band diagrams - Fermi Dirac statistics - Dopant diffusion techniques - Critical temperature of extrinsic semiconductors - Drift of carriers - conductivity and mobility of electrons and holes - Diffusion of carriers - Diffusion and draft of carriers - P-N junction - Space charge at a junction - Avalanche Breakdown - P-

	N junction capacitance - Zener breakdown.
<b>17-20</b>	<b>Diodes</b> Semiconductor diodes - Special purpose diodes - Diode applications.
<b>21-25</b>	<b>Basic Transistors</b> Bipolar junction transistor - Transistor operation - Types of transistor -Biased transistor - Transistor biasing configurations - Common emitter - Common base - Common collector -
<b>26-28</b>	<b>Other Transistors</b> Field effect transistor - FET biasing techniques - common drain - common source and gate - fixed bias and self bias configurations.
<b>29-30</b>	<b>MOSFET - IGFET-DMOSFET - MOSFET applications</b>
<b>Practical syllabus</b>	
<b>1</b>	Measuring the rotation of plane of polarization of light through sugar solution
<b>2</b>	Studying the photo electric current as a function of intensity of light
<b>3</b>	Determination of the ratio of electron's charge and mass(e/m) by magnetron experiment
<b>4</b>	Learning how to use the electronic devices
<b>5</b>	The properties of diodes in forward and reverses bias
<b>6</b>	Half wave rectifiers
<b>7</b>	Full wave rectifier by bridge
<b>8</b>	Full wave rectifier by transform
<b>9</b>	Clipper circuit (positive, negative, complex)
<b>10</b>	Doublers DC voltage circuit (triple and quarter)
<b>11</b>	Zinger diode properties in forward and reverse bias
<b>12</b>	Using zinger diode of voltage divider with constant resistance load and changed resistance load
<b>13</b>	Common base transistor properties
<b>14</b>	Common emitter transistor properties
<b>15</b>	Common base amplifier (finding voltage gain and current gain)
<b>16</b>	Common emitter amplifier (finding voltage gain and current gain) and drawing the frequency response curve.
<b>17</b>	H-parameters measurements for common emitter
<b>18</b>	H-parameters measurements for common base
<b>19</b>	Using transistors in orgnizeing voltage circuits
<b>20</b>	Field Effect Transistor (FET) properties
<b>21</b>	Common source amplifier
<b>22</b>	Common drain amplifier
<b>23</b>	Light Emitting diode
<b>24</b>	MOSFET

**Recommended Books:**

## Text books:

- Microelectronic Circuits by Adel S. Sedra & Kenneth C. Smith.
- University Physics by Sears & Zemansky (4th Edition).

## Reference:

- Physics by Robert Renick & David Halliday.
- Circuit Analysis by John R. O'Malley.
- Electronics Circuits Discrete & Integrated by Schilling and Belowe.

**Subject Number: AVTE 131**  
**Subject : Mechanics (Statics & Dynamic)**  
**L T P C**  
**2 1 0 4**

Objectives of Course:

To understand general principles of bodies at rest and at equilibrium under the action of forces. Then, developing the ability to visualize physical configurations in terms of real materials, actual constraints and practical limitations which govern the behavior of machines and structures.

### Theoretical syllabus

Week	Contents
1	<b>Introduction to Statics</b>
2 - 5	<b>Vectors- Forces - Force in 3D - Moments - Couples - Resultant</b>
6-9	<b>Equilibrium - Planes Trusses - Joint Method - Section Method - Trusses in 3D</b>
10-11	<b>Frames and Machines - Friction - Wedges and Screws - Belts</b>
12	<b>Application of friction on bearings</b>
13-15	<b>Centered of line , area and volume - Moment of inertia - Theory of parallel axes - Problems</b>
16	<b>Rectilinear motion</b>
17	<b>Curvilinear motion</b> -x-y coordinates -Normal – Tangential coordinates -Polar – coordinates
18	<b>Relative motion</b> -Motion relative to a frame in translation
19	<b>Kinetics of particles</b> -Newton's 2 <sup>nd</sup> law - Rectilinear motion - Curvilinear motion
20	<b>Work and energy of particles</b> -Work of a force
21	<b>Impulse and momentum of particles</b> -Impulsive motion -Angular momentum of a particle
22	<b>Conservation of liner momentum</b> -Liner impact
23	<b>Conservation of momentum</b> -Conservation of angular momentum -Impact - Impulse and momentum of particles
24	<b>Angular momentum</b> -Rate of changed of angular momentum -Conservation of angular momentum
25	<b>Kinematics of rigid bodies</b> -Translation of rigid bodies -Rotation of rigid bodies
26	<b>Absolute motion</b> -General motion -Absolute and relative velocity in plane motion -Instantaneous center of rotation -Absolute and relative acceleration
27	<b>Moment of inertia</b> -Mass moment of inertia
28	<b>Force/mass/acceleration</b> -Force/mass/acceleration for rigid bodies
29	<b>Work and energy</b> -Work for rigid bodies -Energy for rigid bodies
30	<b>Impulse and momentum</b> -Impulse for rigid bodies -Momentum for rigid bodies

#### Recommended Books:

Text Books:

- Engineering Mechanics by J L Meriam and L.G. Kraige.

- Engineering Mechanics (Dynamics) by J.L. Meriam & G Kraige.

Reference Books:

- Engineering Mechanics by Irving H. Shames.
- Engineering Mechanics (dynamics) by R. C. Hibbeler
- Engineering Mechanics by Higdon and Stiles.

**Subject Number: CREQ 141****Subject : Eng. Drawing & Descriptive Geometry****L T P C****0 0 3 3**

Specific Objectives of course:

To introduce basic concepts of engineering drawing with emphasis on orthographic drawings, drafting principles and practices.

Week	Contents
1	<b>Introduction to engineering drawing and eng. drawing equipment</b> - Introduction to engineering drawing and its importance to the engineer - History of eng. drawing - The standard drawing equipment
2	<b>Lettering</b> - The lettering and circles kind - The paper type and design with title table - Draw eng. Lines type and circles
3 - 5	<b>Applied geometry</b> - Applied geometry in eng. Drawing - Draw important eng. geometry - Exercise in engineering geometry - Exercise in engineering geometry
6 - 8	<b>Pictorial drawing (Real model in true dimension)</b> - Draw cube shape with ovals by used four center method. - Non standard letters - Exercise in pictorial drawing - Exercise in pictorial drawing
9	<b>Orthographic projection</b> - Projection theory with definition standard planes (Horizontal and Vertical) - Exercise in projection
10	<b>First angle projection</b> - Three projection definition (front, top and side view) - Draw in first angle - Exercise in projection
11 - 12	<b>Dimensions</b> - Main rules in dimensions position and details in drawing - Exercise in applied dimension on projection view - Rules in dimension position for arcs and circles - Exercise in applied dimension on projection view
13 - 14	<b>Orthographic</b> - Exercise in projection - Exercise in projection
15 - 19	<b>Sections</b> - Sections definition - Find sections and section planes and half section projection - Exercise in sections - Exercise in sections - Exercise in sections - Exercise in sections - Exercise in sections
20 - 24	<b>Third view estimate</b> - Important steps to estimate third unknown projection depending on the known two projection - Estimate real model - Exercise in estimate third unknown projection - Exercise in estimate third unknown projection - Exercise in estimate third unknown projection - Exercise in estimate third unknown projection
<b>CAD I -</b>	
Week	Contents
1	<b>Introduction to CAD packages</b> - Menus - Tool bars
2	<b>Drawing area</b> - Command window / Command line - Status bar
3 - 6	<b>Coordinate system (absolute and relative Coordinate)</b> - Cartesian - Cylindrical - Spherical - Setting up drawing limits



7 - 8	<b>Two dimensional drawing</b> - Drawing bar (line, circle, rectangle, ...etc) - Modify bar (erase, copy, mirror,...etc)
9 - 12	<b>Drawing aids</b> - Grid - Snap mode - Object snap - Object snap tracking - Orthogonal mode - Polar tracking
<b>Descriptive Geometry</b>	
<b>Week</b>	<b>Contents</b>
1 - 2	<b>Descriptive geometry</b> - Descriptive geometry and methods of projection - Descriptive geometry and methods of projection
3 - 6	<b>Projection of point</b> - Projection of point - Exercise in projection of point - Exercise in projection of point - Projection of straight line - Exercise in projection of straight line - Exercise in projection of straight line
7 - 8	<b>Auxiliary planes</b> - Auxiliary planes - Exercise in auxiliary planes - Exercise in auxiliary planes
9 - 10	<b>Applications</b> - Exercise in projection of straight line by rotation method - Exercise in projection of straight line by rotation method
11 - 12	<b>Development of surface</b> - Introduction and describe development of surface - Exercise in projection triangular shape - Exercise in projection triangular shape

**Recommended Books:**

- Fundamentals of Engineering Drawing by French & Vierck.
- Getting started with Solid Edge. Version 12, by Unigraphics Solution Inc.
- Fundamentals of drafting with AutoCAD LT by Paul Wallach, Dean Chowenhill & James Cullen.

**Subject Number: CREQ 142****Subject : Programming I****L T P C****1 0 2 4**

Objective of Course:

Introduction and familiarization with the working and understanding of computer and its use/applications in various engineering subjects in particular and society in general.

**Theoretical syllabus**

<b>Week</b>	<b>Contents</b>
<b>1-6</b>	<b>Computer Fundamentals</b> Introduction – Evolution of Computers – Generations of Computer – Classification of Computers – Application of Computers - Components of a Computer System – Hardware - Software - Starting a Computer (Booting) – Number Systems.
<b>7-13</b>	<b>Computer Programming and Languages</b> Introduction - Problem-Solving Techniques: Algorithms, Flowchart, Pseudocode - Program Control Structures – Programming Paradigms – Programming languages – Generations of Programming Languages – Language Translators – Features of a Good Programming Languages
<b>14-16</b>	<b>Programming With C</b> Introduction to C - Arrays Definition - Declaration and initialization of one dimensional array - Accessing array elements - Displaying array elements - Sorting arrays - Arrays and function - Two-Dimensional array - Declaration and Initialization - Accessing and Displaying - Memory representation of array [Row Major, Column Major] - Multidimensional array.
<b>17-18</b>	<b>Pointers</b> Definition and declaration - Initialization - Indirection operator - Address of operator - Pointer arithmetic - Dynamic memory allocation - Arrays and pointers - Function and pointers
<b>19-21</b>	<b>Strings</b> Definition - declaration and initialization of strings - standard library function: strlen(), strcpy(), strcat(), strcmp() - Implementation without using standard library functions.
<b>22-24</b>	<b>Structures</b> Definition and declaration - Variables initialization - Accessing fields and structure operations - Nested structures Union: Definition and declaration - Differentiate between Union and structure.
<b>25-27</b>	<b>Introduction C Preprocessor</b> Definition of Preprocessor - Macro substitution directives - File inclusion directives - Conditional compilation <b>Bitwise Operators</b> Bitwise operators - Shift operators - Masks - Bit field
<b>28-30</b>	<b>File handling</b> Definition of Files - Opening modes of files - Standard function: fopen(), fclose(), feof(), fseek(), fwind() - Using text files: fgetc(), fputc(), fscanf()

**Practical syllabus**

<b>1-5</b>	Internal command (Dir - Del - Time - Date - Cls - RD- CD - MD - Echo - Prompt - Ren - Copy - Vol - Ver - Path) External Command (Edit - tree - xcopy - format - chkdsk - Diskopy).
<b>5-10</b>	Windows
<b>11-13</b>	standard library function: strlen(), strcpy(), strcat(), strcmp() - Implementation without using standard library functions.
<b>14-15</b>	Variables initialization - Accessing fields and structure operations - Nested structures -
<b>16-17</b>	Union: Definition and declaration - Differentiate between Union and structure.
<b>18-19</b>	Macro substitution directives - File inclusion directives - Conditional compilation

20-21	Bitwise operators - Shift operators - Masks - Bit field
22-24	Opening modes of files - Standard function: fopen(), fclose(), feof(), fseek(), rewind()
25-26	Using text files: fgetc(), fputc(), fscanf()

**Recommended Books:**

## Text Book:

- Computer Programming, by ITL Education Solution Limited, Ashok Kamthane, Pearson Education Inc 2007 (Unit: I to V).

## References:

- Programming with C, by Byron S. Gottfried, Second Edition, Tata McGraw Hill 2006.
- Programming in C - A Complete introduction to the C programming language, by Stephen G.Kochan, Pearson Education, 2008.
- Computer Programming Theory and Practice, by T.JeyaPoovan, Vikas Pub, New Delhi.

**Subject Number: CREQ 143****Subject : Workshop**

L T P C

0 0 6 6

## Objectives of Course:

To introduce students different workshops types (electronics and mechanics ) workshops, tools used in each workshop, and manufacturing techniques of different workshops.

**Mechanics (6 hours)**

Week	Contents
1-4	Occupational Safety
5-9	Foundry Workshop
10-14	Files type Workshop
15-19	Carpentry Workshop
20-25	Turnery workshop
26-30	Welding types Workshop

**Electronics (6 hours)**

Week	Contents
1	Learn how to use different measuring devices in the workshop
2	Learn how to use caustic, types of caustic, welding by using caustic
3	Types of welding, Auxiliary materials for welding, wires welding between them and with other components.
4	Sucker solder and Solder removal, Training to remove some of the electronic components of the printed board
5-6	Learn different types of printing board through printing method, drilling operation, Install the various components.
7-9	Different types of electronics components through manufacturing for example the resistance and its power, measure the value of resistance in different methods, rheostat
10-12	Parallel resistance circuit - series resistance circuit - parallel and series resistance circuits - and check it.
13	Types of capacitance
14-15	Parallel capacitance circuit - series capacitance circuit - parallel and series capacitance circuit - check it on the board.
16	Switch types
17	Fuses types
18	Inductor types
19	Transformer types
20-22	Semi conductor (diode -transistor, .... ) through manufacturing, material used in its manufactured, its numbering methods, its equivalent circuits, checking, determination the faults
23-26	Electrical installation
27	Integrated circuit
28	Caustic used in integrated circuit welding
29	Learn how to read electronic board
30	Students learn to design electronic board on the printed board, install the component on the board, and welding the components on the board.

**Subject Number: MATH 151****Subject : Mathematics - I****L T P C****3 0 0 6**

Objectives of The Course:

To provide comprehensive foundation of applied algebra and calculus with emphasis on vectors, complex numbers, matrices, limits, differentiation, integration, and coordinate systems.

Week	Details
1	<b>General Concepts, Slope</b> - Cartesian Coordinates - Slope of a line - Equations and distances
2	<b>Graphing of functions, Limits</b> - Graphs of equations - Limits and intervals
3	<b>Continuity</b> - Domain and Range - Continuity test
4-7	<b>MATRICES</b> Review: Basic concepts of matrices-addition, subtraction, multiplication of matrices – adjoint –inverse – solving cubic equations. Characteristic equation – Properties of Eigen values – Eigen values and Eigen vectors – Cayley Hamilton theorem (without proof) – Verification and inverse using Cayley Hamilton theorem. Diagonalisation of matrices – Orthogonal matrices– Quadratic form – Reduction of symmetric matrices to a Canonical form using orthogonal transformation – Nature of quadratic form.
7-8	<b>Complex Numbers</b> - Introduction to complex numbers - Argand diagrams and product quotients
9	<b>Demaiver's Theorem</b> - Powers and roots
10-11	<b>Trigonometric and inverse trigonometric functions</b> - Trigonometric functions- Properties- Rules- Graphing- Applications- Rules- Properties
12	<b>Logarithmic and exponential functions</b> - Logarithmic and exponential functions - Properties - Rules
13-14	<b>Hyperbolic and inverse hyperbolic functions</b> - Graphing- Properties- Rules- Properties- Rules- Graphing
15-19	<b>Derivatives of functions (logarithmic, exponential, trigonometric, hyperbolic functions) and its applications:</b> - Rules of derivatives- Chain rule- Implicit derivatives- Rules of derivatives of logarithmic and exponential functions- Derivatives of trigonometric and inverse trigonometric functions- Derivatives of hyperbolic and Inverse hyperbolic functions- L'Hapital rule- Velocity and acceleration- Max. and Min. - Point of inflection
20-22	<b>Indefinite Integrals</b> - Integration formulas- Integration of logarithmic and exponential functions- Trigonometric and inverse trigonometric functions
23	<b>Methods of Integration</b> - Integration by parts- Integration for odd and even powers of sine and cosine
24	<b>Integration of Trigonometric</b> Substitutions - Trigonometric Substitutions - Integral involving $a x^2 + b x + c$
25	<b>Integration of Partial fractions and Rational functions</b> - Partial fractions - Rational functions of $\sin x$ and $\cos x$ and other trigonometric functions
26	<b>Applications of Integration</b> - Definite integral and area

27	<b>General Substitutions</b> - Length of the curve and surface area
28	<b>Triple Integrals (volume)</b> - Triple Integrals (volume)
29	<b>Double Integrals</b> - Area between two curves
30	<b>General Substitutions and quiz</b> - Quiz, answers and solutions

**Recommended Books:**

## Text Books:

- Calculus and Analytic Geometry by Thomas.
- Advanced Engineering Mathematics by Kreyszig.

## Reference Books:

- Analytic Geometry and calculus with Vectors by Agnew.
- Practical Mathematics Vol-I & II by Toft & Mckay.
- Advanced Calculus for Application by Hildebrand.
- Vector Calculus by Bedford F W & Dwivedi.

**Subject Number: UREQ 161**  
**Subject : Human Right & Democracy**  
**L T P C**  
**2 0 0 4**

Objective of course:

To study the laws and principle of the human right & democracy from the perspective of Islamic religion and other religions.

Week	Contents
1	<b>Freedom &amp; Democracy</b> - An introduction to freedom and democracy in multiple societies and on different ages, its types and how changes in regime occurred
2	<b>Relativity in freedom</b> - Freedom is not an absolute idea but it is variable with respect to time, place regime...etc.
3	<b>General Freedom guaranties</b> - Freedom has political and legal guaranties.
4	<b>General freedom divisions</b> - Natural freedoms, private freedoms, intellectual freedoms, collective freedoms and political freedoms
5	<b>Individual Freedoms</b> - Opinion freedom, expression freedom, press freedom...etc.
6	<b>Democracy &amp; political systems</b> - Overview about democracy and its history
7	<b>Democracy types</b> - Direct and indirect
8	<b>Dictatorship and its specification</b> - Overview and specification
9	<b>Concepts about democracy</b> - Traditional meaning and modern meaning.
10	<b>Democracy in Greek Civilization VS. Current democracy</b>
11	<b>Current crisis of democracy</b> - Economical, social, cultural and political difficulties
12	<b>Civil &amp; political rights</b> - Which includes life right, personal freedom, possessing, contracting family...etc.
13	<b>Individual importance and its relation with nation and regime</b>
14	<b>Importance and specifications of sovereignty</b>
15	<b>Main portions of a country</b> - People, land, government and sovereignty
16	<b>Human rights in human history</b> - Human rights in ancient ages like Mesopotamian, Greek, and Roman civilizations
17	<b>Human rights in divine religions</b> - In Christian and Islamic
18	<b>Human rights</b> - Overview, properties and types
19	<b>International confession of human rights</b>
20	<b>Territorial confession of human rights</b> - international and legal resources from international agreements
21	<b>NGO and its role in the protection of human rights</b>
22	<b>Women rights</b> - In Islamic time
23	<b>Children Rights</b> - In old civilizations - In divine religions - In international agreement on 1989

24	<b>Elections and human rights</b> - Human rights is a concept of free elections
25	<b>Human rights resources in Iraq</b> - Basics of human rights in Iraq from the Iraqi constitution, year 2005
26	<b>Legal resources for human rights</b> - All national legal and foreign legal
27	<b>Human rights resources</b> - In United Kingdom, France and USA
28	<b>Civil Rights</b> - Equality, life freedom rights and house and personal privacy
29	<b>Political &amp; economical rights</b> - Election rights government critique
30	<b>Social &amp; cultural rights</b> - This includes the right of family creation, social and health care, and the right of clean environment



**Subject Number: UREQ 162****Subject : Environment****L T P C****1 0 0 0**

Objective of course:

Week	Contents
1	تعريف البيئة وعناصرها وعلم البيئة والتنبؤ
2	المحيط والتنوع الجيولوجي
3-4	المنظومة البيئية ومكوناتها البيئة وعلاقتها بالانسان
5-6	التلوث البيئي ومستوياته وانواعه تلوث الهواء وانواع ملوثاته
6-8	مصادر تلوث الهواء ومخاطره علاقة التلوث بالمتغيرات المناخية والاحتباس الحراري
9-10	اسباب تلوث المياه ومخاطره
11-12	اسباب ومخاطر تلوث التربة
13-14	التلوث الاشعاعي التلوث بالضوضاء واثاره
15	التلوث البصري والضوئي والداخلي
16-17	سبل معالجة التلوث البيئي والحد منه التخطيط البيئي والتنمية المستدامة
18	الطاقات الجديدة والمتجددة
19-20	الاتفاقيات والمعاهدات ودورها في الحفاظ على البيئة وحمايتها اتفاقية كيوتو ورامسار
21-23	بعض التشريعات البيئية العربية والدولية قانون حماية البيئة العراقي
24	مؤسسات الدولة والمواطن ومنظمات المجتمع المدني ودورها في الحفاظ على البيئة
25-27	دور الاديان في المحافظة على البيئة وحمايتها تعليمات وارشادات في المحافظة على البيئة وحمايتها
28-30	دروس وتصانح في حب البيئة والحفاظ عليها ومنع تلوثها

1- زينب منصور, المعجم البيئي, دار اسامة للنشر والتوزيع , الطبعة الاولى , الاردن, عمان , 2011.

2- Cunningham W. P., Cunningham M. A., Saigo B. W., Environmental science A Global Concern, 9th Edition, McGraw-Hill, New York, 2007.

**Subject Number: UREQ 163****Subject : English****L T P C****1 0 0 0**

Objective of course:

<b>Week</b>	<b>Contents</b>
<b>1-4</b>	<b>Basics of Grammar</b> Parts of speech and use of articles Sentence structure, active and passive voice Practice in unified sentence Analysis of phrase, clause and sentence structure Transitive and intransitive verbs Punctuation and spelling
<b>5</b>	<b>Comprehension</b> Answers to questions on a given text
<b>6-7</b>	<b>Discussion</b> General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students)
<b>8-10</b>	<b>Listening</b> To be improved by showing documentaries/films carefully selected by subject teachers
<b>11-12</b>	<b>Translation skills</b> Urdu to English
<b>13-15</b>	<b>Paragraph writing</b> Topics to be chosen at the discretion of the teacher
<b>16-18</b>	<b>Paragraph writing</b> Practice in writing a good, unified and coherent paragraph
<b>19</b>	<b>Essay writing</b> Introduction
<b>20-21</b>	<b>CV and job application</b>
<b>22-24</b>	<b>Translation skills</b> Urdu to English
<b>25-26</b>	<b>Study skills</b> Skimming and scanning, intensive and extensive, and speed reading, summary and précis writing and comprehension
<b>27-28</b>	<b>Academic skills</b> Letter/memo writing, minutes of meetings, use of library and internet
<b>29-30</b>	<b>Presentation skills</b> Personality development (emphasis on content, style and pronunciation)

**Recommended books:****Functional English**

## a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492

2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 019431350661

## b) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

## c) Reading/Comprehension

1. Reading. Upper Intermediate. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

### Communication Skills

#### a) Grammar

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19431350 6.62

#### b) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).

2. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).

#### c) Reading

1. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.

2. Reading and Study Skills by John Langan

3. Study Skills by Richard Yorky.

Sl. No.	Code	Course Type	Course Title	L	P	T	C
1	AVTE 213	Core	Digital Systems - Basics & Applications Logic	2	3	5	6
2	AVTE 214	Core	Electronic Circuits & Electrical Machine	2	3	5	6
3	AVTE 215	Core	Aircrafts Structure & Aerospace Technology	2	2	4	6
4	AVTE 221	Core	Electromagnetic Field Theory	2	2	4	6
5	AVTE 232	Core	Thermodynamics of Propulsion Applied Aerodynamics-Basics	2	0	2	4
6	CREQ 245	Core	Training	-	-	-	-
7	AVTE 222	Secondary	Probability, Signals & Systems	2	2	4	6
8	MATH 252	Secondary	Mathematics II	3	0	3	6
9	CREQ 244	Secondary	Programming II	1	2	3	4
Total				16	14	30	44
%67The perce. of core hours = % 33 The perce. of secondary hours =				% 53The perce. of theoretical hours = %47The perce. of practical hours =			

**Subject Number: AVTE 213****Subject : Digital Systems - Basics & Applications Logic**

L T P C

2 0 3 6

Objective of the course:

To provide an introduction to the fundamentals of logic, truth table, & understanding the logic circuits and systems. In additive, analysis and design the simple logic circuits.

**Theoretical syllabus**

Week	Contents
1-2	<b>Number systems</b> binary - decimal - octal and hexadecimal number systems - conversion between number systems - binary codes - arithmetic operation of binary system.
3-5	<b>Logic gates, Boolean Algebra &amp; Simplification of logic circuits</b> logic gates - logic circuit - logic equation and truth table (product of sum and sum of product) - simplification of logic circuit (Boolean algebra and Karnugh maps) - two, three, four variable K-map - don't care conditions - Demorgan's laws - NAND, NAND network - Binary codes
6-7	<b>Arithmetic Logic Circuits</b> Half & Full adder - Half & Full subtractor - Serial and parallel binary adders - (1'S and 2'S) complements circuit - BCD adder - comparator circuits.
8-9	<b>Multivibrators</b> RS flip flop - clocked RS flip flop - D flip flop - T flip flop - JK flip flop - master/slave flip flop.
10 - 12	<b>Counters</b> Asynchronous counter - design of asynchronous counters - synchronous counters - design of synchronous counters. Examples: 4bits counter - (Up-down) counter - Ripple counter - (Mod-10) counter - Counter applications.
13-14	<b>Registers</b> Serial shift register - Parallel shift register - Ring counter - Static and dynamic registers - Johnson counter
15-16	<b>Multiplexer, Demultiplexer, Decoder, Encoder</b>
17-18	<b>Test of logic circuit - Fault model - Path Sensitizing - Random test - Test of sequential circuit.</b>
19-22	<b>Synchronous sequential circuit</b> Basic design steps - Mealy state model - Serial adder example - Design of counter using sequential circuit.
23-26	<b>Asynchronous sequential circuit</b> Analysis of asynchronous circuit - Synthesis of asynchronous circuit - State reduction - State assignment - Hazard
27-28	<b>555 Timer</b> 555 Architecture - Astable circuit design - Mono stable circuit design.
29-30	<b>Convertors</b> D/A and A/D converter - Types of D/A - Types of A/D - D/A accuracy and resolution
<b>Practical syllabus</b>	
1	logic gates (AND,OR, & NOT ) using diodes , transistor ,& resistors.
2	Implement logic gates (AND,OR, NOT, AND, NOR, XOR &XNOR)
3	logic gates (AND,OR, NOT,NAND,NOR, XOR, &XNOR) by using integrated circuits IC{7408, 7432, 7404, 7400, 7402, 7486 ,&74266}
4	Boolean's algebraic
5	Demorgan's theorem
6	Implement logic gates (AND,OR, NOT, NAND, NOR, XOR &XNOR) using NAND &

	NOR gates only
7	1bit comparator - 2bits comparator - 3bits comparator
8	Half adder - Half subtract - Full adder - Full subtract
9	2-bits multiplication circuit
10	Coding circuit from BCD to Cray code
11	SR flip flop - JK flip flop -D flip flop -T flip flop -
12	Serial counter (Asynchronies counter) A-Up counter , B-Down counter
13	Parallel counter (Synchronies counter)
14	Johnson & ring counter
15	Decade counter
16	Shift register A- Shift right register (SRR) , B- Shift left register (SLR)
17	Sequense detector
18	Compound counter
19	Multiplexer: A-4x1 multiplexer using logic gates, B-8x1 multiplexer using IC 74151
20	Decoder 2x4 using logic gates
21	Serial adder example - Design of counter using sequential circuit
22	Synthesis of asynchronous circuit
23	State reduction - State assignment
24	Hazard
25	555timer (Astable circuit design - Mono stable circuit design)
26	Parity checker
27	Digital to analog converter (D/C)
28	Analog to digital convertor (A/D)

**Recommended Books:**

- Digital principles and applications, by Albert Paul Malvino, 2<sup>nd</sup> Edition.
- Digital Logic Circuits by D.A.Godse A.P.Godse, Technical Publications 2008.

**Subject Number: AVTE 214****Subject : Electronic Circuits & Electrical Machine**

L T P C

2 0 3 6

Objective of the course:

To learn the student analysis and design of operational amplifier, power amplifier, and oscillators. In additive, studying electrical machine in two parts motors and genertors.

**Theoretical syllabus**

Week	Contents
1-3	<b>Operational Amplifiers</b> The basic operational amplifier - The D coupled differential amplifier - Transfer characteristics of a differential offset error voltage and currents - Measurement of operational amplifier parameters - Frequency response of operational amplifiers.
4-6	<b>Linear analog system</b> Basic operational amplifier applications - Differential DC amplifiers analog integrator and differential active filters integrated circuit tuned amplifier - A cascade audio amplifier comparators sample and hold circuits precision AC/DC convertors logarithmic amplifiers - Waveform generators generative comparator (Schmitt trigger).
7-10	<b>Power amplifiers</b> Class A large-signal amplifiers second harmonic distortion - Higher order harmonic generation - The transformer coupled audio power amplifier efficiency - Push pull amplifier class B amplifier - Class AB - Regulated power supply series voltage regulator.
11-13	<b>Feedback amplifiers</b> The feedback concept - The transfer gain with feedback characteristics of negative feedback amplifiers - Input resistance - Output resistance - Method of analysis of a feedback amplifier - Voltage-series feedback - A voltage series feedback pair - Current series feedback - Current shunt feedback - Voltage shunt feedback.
14-15	<b>Oscillators:-</b> Type of oscillators - Oscillators pairs -The Hartley oscillators - The Colpitt oscillators - The ultra audio oscillators - Crystal oscillators - Crystal and temperature coefficients - crystal heater chambers - Crystal holders - Other crystal circuits - Some high frequency oscillators - Audio oscillators - Dynatron oscillators - RC oscillators - Parasitic oscillators - Indication of oscillators - Oscillators stability.
16-17	<b>Introduction</b> Introduction to electrical machines - Classification of electrical machines - Construction of rotating machines.
18	<b>DC machine construction:</b> EMF equation - Torque and speed equations of DC machine. DC generators ( classification of DC generators and characteristic curves for each type).
19-20	<b>Losses and Efficiency of DC generators:</b> DC Motors ( classification of DC motors and characteristic curves for each type) - Speed control of DC motors - Starting of DC motors - Testing of DC machines - Uses of DC motors.
20-21	<b>Transformers:</b> (Basic principle, construction of single phase transformer, and EMF equation) - Transformer Equivalent Circuit - Tests on transformers - Losses and Efficiency - Current and voltage transformers - Auto transformer - 3-phase power transformers.
22-23	<b>Three phase induction motors:</b> (construction, theory of rotating magnetic field, speed and slip) - Equivalent circuit of 3-phase IM, Torque – slip, and torque speed characteristics. Tests on IM - Losses - Power stages and Efficiency - Starting and speed control of 3-phase IM, .
24-25	<b>Single phase motors:</b> (classification , methods of rotating field production) - Equivalent circuit of single phase

	IM. Tests on single phase IM - Losses and Efficiency.
26-27	<b>Synchronous Machines:</b> (general theory and construction) - Alternator equivalent circuit - voltage equation - Phasor diagram - and voltage regulation. Load characteristic of alternator - Input and output power equations.
28-29	<b>Synchronous Motors;</b> (principle of operation and phasor diagram) - Load characteristic of synchronous motor - Input and output power equations - Max. output power. Torque equation - Methods of starting - Applications of synchronous Motors.
30	<b>Special Purpose Motors:</b> Linear motors - Stepper motors. DC Servomotors and AC Servomotors. Conversion from AC to DC.

### Practical Syllabus

1	Inverter amplifier circuit by operational amplifier
2	Non-inverter amplifier circuit by operational amplifier
3	Summation amplifier circuit by operational amplifier
4	Subtract or amplifier circuit by operational amplifier
5	Integrator amplifier circuit by operational amplifier
6	Differential amplifier circuit by operational amplifier
7	Half wave rectifier circuit by operational amplifier
8	Full wave rectifier circuit by operational amplifier
9	Compactor circuit by operational amplifier
10	Smith trigger circuit
11	Logarithmic amplifier circuit
12	Low pass filter circuit by operational amplifier
13	High pass filter circuit by operational amplifier
14	Square wave generator circuit by operational amplifier
15	Triangle wave generator circuit by operational amplifier
16	Introduction to Industrial safety and security principles
17	Magnetizing curve for separately excited and self excited generators.
18	EMF vs. speed curve for separately excited DC generator and find out the critical resistance.
19	EMF vs. speed curve for shunt DC generator and find out the critical resistance.
20	Load, internal and external characteristic curves for separately excited DC generator.
21	Load, internal and external characteristic curves for shunt DC generator.
22	Load, internal and external characteristic curves for series DC generator.
23	Load, internal and external characteristic curves for compound (cumulative and differential) DC generator.
24	Parallel operation of two separately excited DC generators.
25	Load characteristic, torque curve, and efficiency for DC series motor.
26	Load characteristic, torque curve, and efficiency for DC shunt motor.
27	Speed control for DC shunt motor (Supply voltage and Field current control)
28	Losses and Efficiency calculation for DC machine.
29	Open circuit and Short circuit Tests on single phase transformer.
30	Load Test on single phase transformer.

#### Recommended Books:

##### Text Books:

- Engineering Circuit Analysis by Willian Hayt & Kemmerly.
- Electric Machinery Fundamentals (3rd Edition) by Stephen J. Chapman.

##### Reference

- Engineering Circuit Analysis by James W. Nilsson.
- Introduction to Electric Circuits by Richard C. Dorf.



- Electric Machines: Theory, Operation, Applications, Adjustment and Control by Charles Hubert.

**Subject Number: AVTE 215****Subject : Aircrafts Structure & Aerospace Technology**

L T P C

2 0 2 6

Objective of course:

To provide understanding, analysis and design simple aircraft structural components and its system to the engineering students.

**Theoretical syllabus**

Week	Contents
1-2	<b>Flight controls</b> which dealing with aerodynamics and aircraft control surfaces.
3-5	<b>Aircraft construction</b> Basic structure of aircraft - Landing gears - Hydraulic - Pneumatic and fuel systems
6-7	<b>Principle of jet reaction</b> Thrust and power - factors effecting thrust - Compressors and jet propulsion devices
8-9	<b>Aircraft instruments</b> Flight - Engine auxiliary instruments.
10	<b>Electrical system</b> Power supply - Power generation - Electrical components.
11-12	<b>Armament systems study</b> Aircraft ejection system - Fundamentals of bombs and firearms - Principle and construction of ammunition and explosives .
13-15	<b>Statically determinate structures</b> Analysis of plane truss – Method of joints – 3 D Truss - Plane frames
16-19	<b>Statically indeterminate structures</b> Composite beam - Clapeyron's Three Moment Equation - Moment Distribution Method.
20-23	<b>Energy methods</b> Strain Energy due to axial, bending and Torsional loads – Castigliano's theorem - Maxwell's Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.
24-27	<b>Columns</b> Columns with various end conditions – Euler's Column curve – Rankine's formula - Column with initial curvature - Eccentric loading – South well plot – Beam column.
28-30	<b>Failure theory</b> Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems

**Practical syllabus**

1	Determination of Young's modulus of steel using mechanical extensometers.
2	Determination of Young's modulus of aluminium using electrical extensometers
3	Determination of fracture strength and fracture pattern of ductile materials
4	Determination of fracture strength and fracture pattern of brittle materials
5	Stress Strain curve for various engineering materials.
6	Deflection of beams with various end conditions.
7	Verification of Maxwell's Reciprocal theorem & principle of superposition
8	Column – Testing
9	South – well's plot.
10	Riveted Joints.

- Direct & Alternating Current Machinery by Rosenblatt and Friedman.

**Recommended Books:**

<b>Subject Number: AVTE221</b> <b>Subject : Electromagnetic Field Theory</b> <b>L T P C</b> <b>2 0 2 6</b> Specific Objectives of course: To introduce fundamentals of electromagnetic field theory for understanding and analyzing electromagnetic phenomenon.	
Week	Contents
1-4	<b>Vector Analysis:</b> Scalars And Vectors - Vector Algebra - The Cartesian Coordinate System - Vector Component And Unit Vectors - The Vector Field - Dot Product - Cross Product - Cylindrical Coordinate - Spherical Coordinate - Transformation Between Coordinates -

Text Books: ➤ A naly sis of Airc raft Stru ctur es – An Intr odu ctio n||, by Don alds on, B.K. Mc Gra w- Hill, 199 3. R ef er

#### ence

- Strength of Materials, by Timoshenko, S. Vol. I and II, Princeton D. Von Nostrand Co, 1990

	Del Operator - Laplacian Operator - Gradient - Divergence and Curl - Null Identities.
<b>5-6</b>	<b>Coulomb law</b> Electric field intensity - Field due to continuous volume charge - Field of line charge - Field of sheet charge.
<b>7-10</b>	<b>Electrostatics</b> Electric Flux Density - Gauss Law - Application of Gauss Law - Maxwell First Equation.
<b>11-14</b>	Energy and Potentials in A Moving Point Charge in An Electric Field - The Line Integral - Definition of Potential Difference and Potential - The Potential Field of A Point Charge - Conservative Property - Potential Gradient - The Dipole - Energy Density in The Electric Field.
<b>15-18</b>	Conductors - Dielectric and Capacitance - Current and Current Density - Continuity of Current - Metallic Conductor - Boundary Conditions - Image Theory - Semiconductor - Dielectric Materials - Capacitance - Example of Capacitance.
<b>19</b>	Pisson and Laplace Equations.
<b>20-23</b>	The Steady Magnetic Field - Biot-Savar Law - Amperes Circuital Law - Magnetic Flux and Magnetic Flux Density - The Scalar and Vector Magnetic Potentials - Derivation of The Steady Magnetic Field Law.
<b>24-26</b>	Time varying fields and Maxwell equations - Faraday law - Displacement current - Maxwell equations in point form - Maxwell equation in integral form - The retarded potentials.
<b>27-30</b>	The Uniform Plane Wave - Wave Equation - Wave Propagation in Free Space - Wave Propagation in Dielectric - The Poynting Vector And Power Consideration - Propagation in Good Conductors - Skin Effect - Wave Polarization.

**Recommended Books:****Text Books**

- Elements of Electromagnetic by Matthew N.O. Sadiku (2<sup>nd</sup> Edition).

**References**

- Field and Wave Electromagnetic by David K. Cheng (2<sup>nd</sup> Edition).
- Engineering Electromagnetic by William H. Hayt (2<sup>nd</sup> Edition).
- Electronic communication System by George Kennedy (2<sup>nd</sup> Edition).
- Electromagnetic Waves and Radiating System by Balma.

**Subject Number: AVTE232****Subject : Thermodynamics of Propulsion & Applied Aerodynamics-Basics****L T P C****2 0 0 4**

Objectives of Course:

To understand and develop the essential background and know how of thermodynamics. In additive introducing aerodynamics to Avionics Engineering students.

Week	Contents
1	Zeroth law
2-6	First law and its applications to various systems - Physical properties of pure substances - Use of property tables - PVT relations - Equations of state for ideal gases.
7-10	Second law and its results - reversible and irreversible processes and cycles - Concept of entropy and its uses.
11-12	Applications of the concepts are focused on the Closed Thermodynamics System.
13-15	An introduction to the Open Systems and their applications.
16-22	Definitions and concepts related to the hydrostatics equation and Standard Atmosphere - incompressible and compressible flows and application of continuity - momentum and energy equations in their simplified forms.
23-30	Introduction to wind tunnel design and compressibility effects in aerodynamics flows

**Recommended Books:****Text Books:**

- Engineering Thermodynamics, An introduction Textbook by J. B. Jones/G. A. Hawkins, second edition, John Wiley & Sons Inc, 1986.
- Introduction to Flight by J. D. Anderson, Jr. (2<sup>nd</sup>/3<sup>rd</sup>).

**Reference:**

- Thermodynamics by Kenneth Wark.
- Applied Thermodynamics by T D Estop/Mckonkey.
- Gas Dynamics by E. A. John.
- Fundamentals of Aerodynamics by J. D. Anderson, Jr(2<sup>nd</sup> Ed.)

**Subject Number: AVTE325****Subject : Probability, Signals & Systems**

L T P C

2 0 2 6

Objective of Course:

To develop understanding of fundamentals of probability including various probability distributions and laws of statistics and elementary statistical techniques to effectively analyze scientific data.

Week	Contents
1-2	<b>Introduction:</b> Set Theory - Basic concepts of probability
3-4	<b>Probability types:</b> Conditional probability - Independent events -
5	<b>Baye's formula</b>
6-7	<b>Discrete and continuous random variables - Distributions and density functions</b>
8-9	Probability distributions (binomial, Poisson, Hyper geometric, Normal, Uniform and exponential)
10-15	<b>Mean - Variance - Standard deviations - Moments and generation functions - Linear regression and curve fitting - Limits theorems - Stochastic processes - First and second order characteristics - Applications</b>
16-23	<b>Signals, spectrum, and filters</b> Singularity functions - Periodic signals and Fourier series - Non periodic signals and Fourier transform - Convolution and impulses system response and filters - Correlation and spectral density - Parseval's theorem for energy signals. Laplace Transform - Z-Transform - Analysis of signals and System.
24-27	<b>Ideal &amp; practical filters:</b> LPF(RC & RL) - HPF(RC &RL) - BPF - BSF.
28-30	<b>Noise</b> Band limited white noise - Thermal noise - Noise figure.
<b>Practical Syllabus</b>	
16-17	Analysis of signals
18-20	Periodicity of the signals
21-23	Demonstration of Convulsion
24	Signal sampling using different parameters
25-26	Filter design
27	Calibration of voltage controlled oscillator
28	RF radio amplifier with tuning circuit
29-30	Equalizer effects on the radio amplifier operation

**Recommended Books:****Text Books:**

- Introduction to Statistics by Walpole

**Reference**

- Modern Elementary Statistics by John E. Freund.
- Probability and its engineering uses by T.C.Fry.
- Elementary Statistics by P. A. Games & G. R. Klaro.
- Probability and Statistics by Nestollor, Rourke and Thomas.
- Introduction to Signals and Systems by Oppenheim.
- Signals and Systems- An Introduction by Leslie Balme.

**Subject Number: CREQ 245****Subject : Programming II**

L T P C

1 0 2 4

Objectives of Course:

To introduce students different workshops types, tools used in each workshop, and manufacturing techniques of different workshops.

Week	Contents
1	<b>Introduction to programming using (Matlab)</b> - Introduction to (Matlab) - Menu bar , tool bar, and program windows
2-5	<b>Format, Numbers &amp; Variables</b> Real, Integer , Inf ,NaN, Complex numbers - Variable Names - Examples on variable names - Show the results - Examples on (+ , - , * , /) - Outputs - Intermediate results during calculations.
6-8	<b>Built-in-functions</b> - Trigonometric Functions (sin , cos , tan , sec) - Elementary Functions (abs, log10 , log, exp, sqrt) <b>Functions</b> - polyarea (X,Y) - polygon - Standard Deviation - abs function - (max) - (min) - (mean)
9	<b>Logical commands</b> - Logical Operations - > greater than - >= greater than or equal - < less than - <= less than or equal - == <b>equal</b> - ~= not equal - Logical commands OR ( ), AND (&).
10-12	<b>Strings manipulation</b> - Creating Strings - save <b>Conditional commands</b> - if end - If elseif else function - Examples - Problems
13-14	<b>loops</b> - for - while - Program control - Example - Problems.
15	<b>Matrices</b> - Matrices manipulation
16	<b>Matrices Operations</b> - Matlab as a calculator - Basic mathematical operations - + , - , * , / , ^
17-21	<b>Matrix construction</b> - Extracting Bits of a matrix - Dot product of matrices - Tabulating Functions - Matrix-Vector product - Matrix-Matrix product - Logical commands - Comparison tests - Examples - Problems.
22-23	<b>Vectors</b> - Row Vectors, Colon Notation (:) - Extracting Bits of a vector - Column Vectors - Transposing - Examples and Problems.
24-26	<b>Transformation functions</b> - Rotation, Scaling, Shearing, Reflection, Translation. <b>Write formatted data to file</b> - fid=fopen(filename,'w') fprintf(fid,'format',list of variables) - Examples. <b>Read formatted data from file</b> - fid=fopen(filename,'r') fscanf(fid,'format',size) - Examples.
27-30	<b>Plotting by Matlab</b> - plotting a matrix (Plot) - subplot(m,n,p) - Two dimensional plot - Three dimensional plot - Examples and Problems.

**Subject Number: MATH 252****Subject : Mathematic II**

L T P C

3 0 0 6	
Objectives of Course: To provide detailed knowledge of basic principles, methods, and clear percentage of ordinary differential equations and partial differential equations used in engineering fields especially in mechanics, dynamics, structure, communications and electronics.	
Week	Contents
1-5	<b>Ordinary Linear Differential Equations</b> - 1 <sup>st</sup> order differential equations - Separable - Homogeneous - Exact - Linear - Bernoulli - 2 <sup>nd</sup> Order Differential Equations - Reducible to 1 <sup>st</sup> order - Homogeneous - Non Homogeneous - Higher Order Differential Equations - Homogeneous - Non Homogeneous - Applications
6-9	<b>Sequences and Series</b> - Sequence - Series - Geometric Series - Tests of Convergence - Definition - The General Term Test - The Integral Test - The Comparison Test - The Limit Comparison Test - The Ratio Test - The Root Test - Alternating Series - Power Series - Interval of Convergence - Taylor Series - Maclaurin Series - Applications
10	<b>Fourier Series</b> - Periodic Function - Even and Odd Functions - Half Range Expansion Function
11-14	<b>Partial Differentiation</b> - Definition - Mechanism of Differentiation - Functions of Two Variables - Functions of Higher Variables - Transformation - Chain Rule - Total Differential - Gradient, Divergence, and Curl of Vector - Equation of Normal Line and Tangent Plane - Directional Derivative - Maxima, Minima and Saddle Points - Lagrange Theorem
15	<b>General Applications</b>
16-19	<b>Vector</b> - Vector in Space - Parallel Vectors - Triple Product - Volume of Box - Projection of Two Vectors - Applications - Equation of Line in Space - Equation of Plane in space - Applications - Vector Valued Functions - Curvature - Motion of Particle.
20-22	<b>Applications of Double and Triple Integrals</b> - Sketching of Geometric Shapes - Double Integrals - Triple Integrals - Applications - Jacobian Transformation - Area in Polar Curve - Surface Area
23	<b>Special Functions</b> - Gama Function - Beta Function
24-29	<b>Polar Coordinates</b> - Polar Curve Representation - Sketching of Polar Curve - General Curve Special Curve (Line, Circle, Conic Section) - Rotation of Axis - The Arc Length of Polar Curve - Surface Area of Rotation - The Angle Between The Tangent Line and Radius Vector For a Polar Curve - Slope of Tangent - Asymptotes - Plane Area.
30	<b>General Applications</b>

**Recommended Books:****Text Books:**

- Advanced Engineering Mathematics by Kreyszig.

**Reference:**

- Advanced Engineering Mathematics by Zill & Cullen.
- Introduction to Ordinary Differential equations by Ross.
- Introduction to Partial Differential equations by Sankara Rao.

Awsat Technical University

Sl. No.	Code	Course Type	Course Title	L	P	T	C
1	6AVTE 31	Core	Microprocessors & Microcontroller	2	3	5	6
2	AVTE 317	Core	Airplane aerodynamics-Stability & Control., Avionics Navigation System.	2	2	4	6
3	AVTE 323	Core	Antenna & Transmission Lines	2	0	2	4
4	AVTE 324	Core	Analogy & Digital Communications.	2	3	5	6
5	CREQ 347	Core	Training	-	-	-	-
6	AVTE 325	Secondary	Digital Signal Processing	2	3	5	6
7	CREQ 346	Secondary	Engineering and Numerical Analysis.	3	0	3	6
8	AVTE 318	Secondary	Analog and Digital Control	2	3	5	6
9	UREQ 364	General	Technical Writing and Presentation Skills, International Relations.	1	0	1	2
Total				16	14	30	42
%54The perce. of core hours = %43The perce. of secondary hours = The perce. of general hours = 3%				%53The perce. of theoretical hours = %47The perce. of practical hours =			



<b>Subject Number: AVTE316</b>	
<b>Subject : Microprocessors &amp; Microcontroller</b>	
<b>L T P C</b>	
<b>2 0 3 6</b>	
Objectives of The Course: To develop understanding of principles, structure, programming and applications of microprocessors and microcontroller.	
<b>Theoretical syllabus</b>	
<b>Weeks</b>	<b>Contents</b>
<b>1-2</b>	<b>Memory</b> types of memory - semiconductor memories - ROM - RAM - Memory expansion - word length expansion - word capacity expansion - Types of buses.
<b>3</b>	<b>Introduction</b> Introduction to Intel family microprocessor - Architecture of 8085 microprocessor - Block diagram - Registers - ALU - Control unit.
<b>4-5</b>	<b>Instruction set architecture(ISA)</b> Instruction classification - Instruction set of 8085 - Assembly language programming - Opcode instruction format.
<b>6-7</b>	<b>Pin out of 8085 microprocessor, Buses system, and Control signals.</b>
<b>8-9</b>	<b>Stack and Subroutine</b>
<b>10-11</b>	<b>Looping - Counting - Time delay - Counters - Code conversion.</b>
<b>12-13</b>	<b>Timing diagram</b> Definition - Machine cycle - Instruction cycle - Clock signal representation - Types of machine cycle.
<b>14-15</b>	<b>Interrupts</b> Introduction - Types of interrupt (maskable and non maskable, vectored and non vectored, single-level and multi-level) - Overall 8085 interrupt structures - Interrupt instructions. Addressing modes
<b>16-17</b>	<b>Memory and I/O devices interfacing</b>
<b>18</b>	<b>A microcontroller Survey</b> 4-bit MC - 8-bit MC - 16-bit MC - 32-bitMC
<b>19-20</b>	<b>The 8051 MC</b> Introduction - Features - Hardware - Pin-out of 8051 - Interrupt structure -
<b>21-23</b>	<b>Instruction set and programming of 8051 MC</b>
<b>24-25</b>	8051 MC programming in C
<b>26-27</b>	Introduction of PIC 18F series
<b>28-30</b>	Arduino
<b>Practical syllabus</b>	
<b>1</b>	Understanding of the 8085 kit program
<b>2</b>	Data transfer operations
<b>3</b>	Arithmetic operation (8-bit summation)
<b>4</b>	Logic operation (multiply by 2 using rotate instruction)
<b>5</b>	Clear of memory locations
<b>6</b>	Summation of odd order numbers
<b>7</b>	1s and 2s complement for 8-bit number
<b>8</b>	16 bit operations (summation and complement)
<b>9</b>	8-bit subtraction
<b>10</b>	8-bit multiplication
<b>11</b>	Find larger number
<b>12</b>	BCD to binary
<b>13</b>	Binary to BCD

14	Hexadecimal to ASCII code
15	ASCII TO binary
16	I/O ports
17	Time delay
18	Maximum repetition for block of data
19	8-bit division
20	Microcontroller Kit
21	Arithmetic operation
22	Logic operation
23	Interfacing
24	Control operation
25	Flowcode definition
26	Arduino
27	Arduino applications

**Recommended Books:**

## Text Books:

- Digital Computer Electronics by Malvino Brown.
- Microcomputer systems 8086/8088 family, Architecture, Programming and Design, by Yu-Cheng Liu & Glenn A Gibson, 2nd Edition- July 2003, Prentice Hall of India.

## Reference Books:

- Microprocessor and Interfacing, Programming & Hardware, by Douglas V Hall, 2nd Edition, Tata McGraw Hill .
- Microprocessor Architecture, Programming and Applications with the 8085, by Ramesh S Gaonkar, 4th Edition, Penram International.
- The 8051 Micro Controller by Scott Mackenzie

**Subject Number: AVTE 318**  
**Subject : Airplane aerodynamics - Stability & Control, Avionics Navigation System.**

**L T P C**  
**2 0 2 6**

Objectives of Course:

To build on the knowledge of basic aerodynamics and extends it to airplane aerodynamics. In additive, providing an introduction to the fundamentals of missile guidance systems, the science of aerial navigation and its related technology.

### Theoretical syllabus

Week	Contents
1-3	<b>Concepts</b> Related to flow over airfoils - Compressibility effects on lift - Drag generation.
4-6	Differences between infinite and finite wings
7-10	Simplified analysis of aircraft performance
11-15	Various key concepts related to static stability of aircraft.
16-20	<b>Guidance</b> Introduction to missile guidance - Navigation systems - Kalman filtering and flight controls - principles proportional guidance and various factors affecting acceleration requirements and miss distance.
21-25	<b>Navigation</b> Major thrust on GPS - INS & their integration via the Kalman Filter
26-30	<b>Controls</b> Introduction to the 6-DOF Flight Dynamics model and methods of stability augmentation via linear feedback.

### Practical syllabus

1	Simulation of nonlinear homing guidance
2	Comparison of linear and nonlinear solutions
3	Miss distance computation using method of AD joints
4	Noise propagation in command guidance
5	Simulation of beam rider guidance
6	Introduction to mapping toolbox
7	Simulation of Kalman filter
8	GPS, Aircraft dynamic,
9	Phugoid and short period modes
10	Effect of flight control transfer on aircraft stability
11	Demonstration of flight control on twin rotor MIMO System

### Recommended Books:

Text Books:

- Introduction to Flight by J. D. Anderson, Jr. (2<sup>nd</sup>/3<sup>rd</sup>) Edition.
- Tactical and Strategic missile Guidance, 3<sup>rd</sup> Edition by Paul Zarchan.
- Avionics Navigation Systems 2<sup>nd</sup> Edition by Nyron Kayton and Walter.
- Flight Dynamics Principles by M. V. Cook.

Reference Books:

- Gas Dynamics by E. A. John.
- Fundamentals of Aerodynamics by J. D. Anderson, Jr(2<sup>nd</sup> Ed.).
- Aeroplane Aerodynamics by Domasch, Sherby and Conally.
- Aerospace Sensor Systems and Applications by Shmuel Merhav.

- Global Positioning System, Inertial Navigation and Integration by M. S. Grewal.

**Subject Number: AVTE 323****Subject : Antenna and Transmission Lines**

L T P C

2 0 0 4

Objective of course:

To provide an introduction to the fundamentals of electromagnetic wave propagation in both guided structures and open media. In additive, introducing a unified manner, the fundamentals of antenna theory, parameters, principles, arrays, and apply them to antenna analysis and measurement.

**Theoretical syllabus**

Week	Contents
1-3	Maxwell equations - Continue equation - Maxwell Equations for Time Varying Fields - Boundary Conditions - Time Varying Potentials - Heuristic Approach - Retarded Potentials - Maxwell Equation Approach - Helmholtz Theorem - Solution of The Wave Equation - Poynting Vector
4-6	Antenna Definition - Properties of Antenna - Types of Antenna - Block Diagram of Communication Systems - The Isotropic - The Ideal Dipole - Radiation Mechanism.
7-11	Antenna Parameters - Radiation Pattern - Field Regions - Radian And Steradian - Radiation Intensity - Directivity - Power Gain. Radiation Efficiency - Effective Length - Effective Area - Front To Back Ratio - Antenna Bandwidth - Antennas In Communication( Friis Formula) - Antennas in Radar System - Antenna Polarization - Polarization Mismatch - Reciprocity Theorem - Input Impedance of Antenna - Antenna Temperature.
12-15	Thin Linear Antenna - Short Dipole - Monopole - Dipole Antenna - Small Loop Antenna - Plot of Radiation Pattern - Image Theory.
16-19	Antenna Arrays - Linear Array - Pattern Multiplication - Two Element Array - Uniform Array - End Fire Array - Broad Side Array - Non Uniform Array - Binomial Array - Chebychev Array Synthesis - Planer Array
20-24	Special Antenna - Aperture Antenna - Folded Dipole Antenna - Yagi-Uda Antenna - Helical antenna - Biconical antenna - Spiral antenna - Microstrip patch antenna
25-27	Antenna Measurements - Antenna Measurement Range - Radiation Pattern Measurement - Gain and Directivity Measurement - Polarization Measurement - Input Impedance and Input Reflection Measurement.
28-30	Radio Wave Propagation - Ground Wave - Free Space Propagation - Ground Reflection - Surface Waves - Diffraction - Wave Propagation in Complex Environment - Troposphere Propagation - Troposphere Scatter - Ionosphere Propagation.

**Recommended Books:****Text Books:**

- Antenna Theory Analysis and Design by C.A> Balanis, John Wille Sons.
- Elements of Electromagnatics by Matthew N. O. Sadiku (2<sup>nd</sup> Edition)

**Reference**

- Antenna Theory and Design by Stutzman
- Field Wave Electromagnetic by Daived K. Cheng (2<sup>nd</sup> Edition).
- Engineering Electromagnetic by William H. Hayt (2<sup>nd</sup> Edition).

<b>Subject Number: AVTE 324</b> <b>Subject : Analogy &amp; Digital Communications.</b> <b>L T P C</b> <b>2 0 3 6</b>  Objectives of Course: To introduce fundamentals of digital communications systems with emphasis on system architectures, signal-to-noise ratio, and bandwidth requirements. Also, introducing an introduction to the fundamentals of microwave devices with emphasis on distinctive features of their construction and understanding of the differences between electrical characteristics in lower frequency bands and RF/Microwave Frequencies.	
<b>Theoretical syllabus</b>	
<b>Week</b>	<b>Contents</b>
<b>1-2</b>	<b>Linear modulation</b> Double sideband modulation AM and DSB modulators and transmitters - SSB and VSB - Frequency conversion - Detection and receivers - Frequency division multiplexing.
<b>3-4</b>	<b>Amplitude modulation</b> The AM transmission - The AM spectrum - Power considerations - Phase representation - AM modulators - Other AM transmitter.
<b>5</b>	<b>Exponential modulation</b> Fundamental concepts - FM spectral analysis - FM bandwidth phase modulation (PM) - Transmitters and receivers
<b>6</b>	<b>Frequency modulation</b> The FM spectrum - Phasor representation - Narrowband FM - Broadband FM - FM generation - FM transmitter - Interference and noise - The PM spectrum PM/FM transmitter.
<b>7-8</b>	<b>Noise in CW modulation</b> System models and parameters - Interference noise in linear modulation - Noise in exponential modulation - Comparison of CW modulation system
<b>9-10</b>	<b>Sampling and pulse modulation</b> Sampling theory and practice - Analog pulse modulation - PAM, PDM and PPM - Pulse code modulation PCM, DM, and DPCM - Time-division multiplexing
<b>11-12</b>	<b>Transmission line theory</b> Transmission line equations - I/P impedance of lines with arbitrary loads - Distortion less lines - VSWR - Reflection coefficients - Matching of transmission lines
<b>13-14</b>	<b>Quantization process</b> - Pulse Code Modulation (PCM) - Representation of binary data - Noise consideration in PCM system - S/N performance of PCM - Limitations and modifications of PCM - Delta modulation - Delta-Sigma modulation - Adaptive delta modulation - Differential PCM (DPCM) - Inter-Symbol Interference (ISI) - pulse shaping to reduce ISI - Equalization - Equalizer types - Matching filter
<b>14-16</b>	<b>Digital Modulation</b> Amplitude Shift Keying (ASK) - Frequency Shift Keying (FSK) - Phase Shift Keying (PSK) - Coherent and non-coherent detection - Differential PSK (DPSK) - Error performance of binary systems - Quadrature Amplitude Modulation (QAM) - Quadrature Phase Shift Keying (QPSK) - Offset-QPSK (OQPSK) - Minimum Shift Keying (MSK) - Multilevel modulation techniques (MFSK, M-ray PSK & M-ray QAM) - Error performance of M-ray systems - Comparison between performance of digital modulation types - Band width efficiency - Power spectra of modulated signals - Carrier recovery & clock recovery.
<b>17-20</b>	<b>Channel coding</b> Error detecting codes - Error correcting codes - systematic and nonsystematic codes

	- hamming distance - hamming weight - linear block codes - Hamming Bound - Hamming code - Encoding of linear block codes - Decoding of linear block codes - cyclic codes - nonsystematic cyclic codes - systematic cyclic codes - Encoding with an (n-k) stage shift register - Encoding with a k-stage shift register - Syndrome calculation and Error detection - Convolution codes - Decoding of convolution codes ( Viterbi algorithm)
<b>21-23</b>	<b>Spread Spectrum System</b> Types of spread spectrum systems - Frequency hopping - Time hopping - Chirp & hybrid - Linear code generation - Synchronization of spread spectrum systems - Acquisition SSS & tracking SSS - Application of SSS.
<b>24-25</b>	Overview of wireless communication system - Type of wireless systems - Generations of wireless communication system.
<b>26-27</b>	Introduction to cellular system - Frequency reuse - Channel assignment strategies - Handoff strategies - System capacity
<b>28-29</b>	Mobile communication system - GSM - CDMA 2000 - UMTS - WCDMA - Handoff management
<b>30</b>	Wireless network - Limitation of wireless network- GSM network hierarchy - Signaling and traffic
<b>Practical syllabus</b>	
<b>1</b>	Pulse generation circuit
<b>2</b>	Sampling circuit
<b>3</b>	ASK modulation
<b>4</b>	ASK demodulation
<b>5</b>	FSK modulation
<b>6</b>	FSK demodulation
<b>7</b>	PSK modulation
<b>8</b>	PSK demodulation
<b>9</b>	PFM modulation
<b>10</b>	PFM demodulation
<b>11</b>	PWM modulation
<b>12</b>	PWM demodulation
<b>13</b>	Random coding circuit
<b>14</b>	Difference modulation
<b>15</b>	Difference Demodulation
<b>16</b>	Power characteristics of transmit diodes
<b>17</b>	Transmission of AC voltage
<b>18</b>	Transmission of 2 analog signals in frequency division multiplex
<b>19</b>	Transmission of frequency-modulated signals
<b>20</b>	Transmission of pulse-frequency modulated signals
<b>21</b>	Transmission of a PCM signal
<b>22</b>	Transmission of a PCM signal
<b>23</b>	Waveguide wavelength and VSWR for different loads
<b>24</b>	Properties of an isolator
<b>25</b>	E-plane & H-plane TEE junction
<b>26</b>	Magic Tees
<b>27</b>	Coupling and Directivity of a directional coupler
<b>28</b>	Measurement of normalized impedance of unknown load.

**Recommended Books:****Text Books:**

- Modern Digital and Analog Communication System by B. P. Lathi, 3<sup>rd</sup> Edition.
- Microwave Devices & Circuits by Samuel Y. Liao

- Passive and Active Microwave Circuit by J. Helszajn.

**Reference**

- Introduction to Communication System by Ferral G. Stremler.
- Principles of Communication System by Herbert Taub & Donald L. Schilling.
- Electronic Communication System by George Kenned.

<b>Subject Number: AVTE 325</b>	
<b>Subject : Digital Signal Processing (DSP)</b>	
<b>L T P C</b>	
<b>2 0 3 6</b>	
Objectives of Course: Learning the student to understanding the mathematical analysis for signals and how can processing it.	
<b>Theoretical syllabus</b>	
<b>Week</b>	<b>Contents</b>
<b>1-3</b>	<b>Continuous and discrete signals and systems</b>
<b>4-5</b>	<b>Linear time-invariant system</b> Introduction (Impulse response, unit step response) - Properties of DSP system (linearity, time-invariance, causality)
<b>6-8</b>	<b>Discrete convolution</b> Linear convolution - Properties of convolution - circular convolution.
<b>9-11</b>	<b>Discrete correlation</b> Cross-correlation and auto-correlation sequence - Properties of Cross-correlation and auto-correlation sequence.
<b>12-16</b>	<b>Z-Transform</b> Definition of the Z-transform (Region of Convergence(ROC)) - Properties of the Z-transform - Stability - Evaluation of the inverse Z-Transform - Long division method - partial fraction expansion.
<b>17-18</b>	<b>Solution of the linear difference equations.</b>
<b>19-20</b>	<b>Frequency analysis of signals and systems</b>
<b>21-24</b>	<b>Discrete Fourier Transform (DFT) - Fast Fourier Transform (FFT)</b>
<b>25</b>	<b>Feedback system</b>
<b>26-28</b>	<b>Implementation of discrete time system</b> Structure of FIR system (direct form structure, cascade form structure) - Structure for IIR system (direct form structure, cascade form structure, parallel form structure)
<b>29-30</b>	<b>Introduction to programmable DSPs - Architecture of TMS 320C5X.</b>
<b>Practical syllabus</b>	
<b>1-3</b>	Study of DFT
<b>4-8</b>	IIR Filter Design
<b>9-11</b>	FIR Filter Design
<b>12-14</b>	FIR Kaiser and Equiripple Filter Design
<b>15-17</b>	Comparison of FIR and IIR Filter Design
<b>18-20</b>	Study of Simulink and Signal Processing Tool Box
<b>21-24</b>	Multi-rate Signal processing
<b>25-27</b>	DSP Processor, TMS 320C6713,DSK Experiments
<b>28-30</b>	TMS 320C6713-Real Time Processing

**Recommended Books:**

- Discrete Time Signal Processing, by Alan V Oppenheim, Ronald W Schafer, John R Back, PHI, 2<sup>nd</sup> Edition 2000.
- DSP Implementation using DSP microprocessor with Examples from TMS32C54XX, by Avtar singh, S. Srinivasan, Thomson / Brooks cole Publishers, 2003.
- Digital Signal Processing, by S. Salivahanan, A. Vallavaraj, Gnanapriya, McGraw-Hill / TMH, 2000.



<b>Subject Number: CREQ 346</b>	
<b>Subject : Engineering and Numerical Analysis.</b>	
<b>L T P C</b>	
<b>3 0 0 6</b>	
Objectives of Course: To prepare students to solve complex problems of engineering using discrete mathematical concepts.	
<b>Week</b>	<b>Contents</b>
<b>1</b>	<b>Laplace Transformations (L.T)</b> - Introduction - Definition of L.T
<b>2</b>	<b>Inverse Laplace Transformations (I.L.T.)</b> - Introduction - Definition of I.L.T
<b>3</b>	<b>Solution of differential equations using L.T</b> - Method of solution - Examples
<b>4</b>	<b>Applications</b> - Using L.T. for solving practical - Problems
<b>5</b>	<b>Solution of 2<sup>nd</sup> order D.E. using power series method</b> - Introduction - Solution near the ordinary point and singular point
<b>6</b>	<b>Bessel's equation + Legendre's equation</b> - Introduction - Application of solution
<b>7</b>	<b>Solution of partial D.E</b> - Definition - Methods of solution of P.D.E.
<b>8</b>	<b>Using of separation method</b> - Definition of separation method - Examples
<b>9</b>	<b>Applications of heat transfer</b> - Solution of unsteady one dimensional heat equation
<b>10-12</b>	<b>Matrices</b> - Introduction and definitions - Special matrices - Properties of matrices, Adj A, A-1 - Rank of a matrix - Vectors - Linear transformation - Orthogonal transformation - Eigen values - Eigen vectors
<b>13</b>	<b>Solution of non- linear equations</b> - Introduction - Application of non- linear equations
<b>14</b>	<b>Simple iteration method + Bisection method</b> - Introduction - Description of methods - Examples
<b>15</b>	<b>Newton –Raphson method</b> - Derivation - Applications - Square Roots - Roots of an arbitrary order - Reciprocal of any number.
<b>16</b>	<b>Solution of simultaneously linear equations</b> - Definition of equations - Methods of solution
<b>17</b>	<b>Direct methods</b> - Matrix inversion - Gauss- Elimination - Gauss -Jordan Elimination.
<b>18</b>	<b>Indirect methods</b> - Jacob's method - Gauss- Seidle method
<b>19</b>	<b>Applications</b> - Examples - problems
<b>20</b>	<b>Curve fitting</b> - linear Regression - Applications of linear regression - Transformation of nonlinear regression to linear regression
<b>21</b>	<b>Numerical interpolation</b> - Introduction - Linear interpolation - Quadratic interpolation
<b>22</b>	<b>Finite differences method + Forward and Backward and center expressions</b> - Introduction to finite differences method - Derivation of formulas with equal step

	size
23	<b>Newton and Lagrange forms</b> - Using this method for equal segment and unequal segments
24	<b>Numerical differentiation</b> - First derivative - Second derivative
25	<b>Numerical Integration</b> - trapezoidal rule - Simpson Rule (1/3) - Simpson Rule(3/8).
26	<b>Two dimensions integration</b> - Applications - Examples
27-28	<b>Solution of ordinary differential equations O.D.E.</b> - Taylor series method - Simple Euler method - Modified Euler method - Runge-kutta method.
29-30	<b>Finite differences method for solution of differential equations</b> - Ordinary differential equations - Partial differential equations Elliptic equation Parabolic equation Hyperbolic equation

**Recommended Books:**

Text Books:

- Fundamentals of numerical analysis by Stephen G. Kellison.

Reference Books:

- A First Course in Numerical Analysis by Anthony Ralston.
- Methods in Numerical Analysis by K. I. Nielsen.

**Subject Number: AVTE319**  
**Subject : Analog and Digital Control**  
**L T P C**  
**2 0 3 6**

Specific Objectives of course:

To provide an introduction to the classical control systems for developing mathematical models to design electromechanical systems using transfer function, root locus and frequency response design techniques. In additive, analysis and implementation of digital control system.

### Theoretical syllabus

Week	Contents
1	<b>Introduction</b> Introduction to control system - Definitions - Historical background - Mathematical background - General natural of engineering control problem - Basic elements of control system - Type of control system - Closed loop - Open loop - Time variant - Time invariant system - linear & non-linear system.
2-3	<b>Mathematical model of dynamic system</b> Mathematical model of writing differential equation - Electrical circuit components - Resistance - Capacitance - Inductance - Analogy of electrical system - Mathematical model of mechanical system - Translation system - Mass - Spring - Dashpot - Rotational system - Analogy of mechanical system- Transfer function - How to determine the transfer function - Advantage - Disadvantage - Properties of transfer function - Multivariable of transfer function.
4	<b>Block diagram</b> Definition of basic block elements - Procedure of drawing block diagram - Block diagram reduction algebra - Mason's formula
4-5	<b>Time response analysis</b> Transient and steady-state region of response - Standard test signals - How to determine order of system from transfer - First order system - Second order system - Time response specification - Example of first order and second order - Higher order system response.
6	<b>Steady-state error response</b> Type of control system - How to determine order from transfer function - Position velocity and acceleration error constant - Method of dynamic error constant.
7	<b>System stability</b> Routh-Hurwitz criteria - Poles and zeros definition - Relation between system parameter and poles location.
8-9	<b>Root-locus analysis.</b>
10-13	<b>Frequency response analysis</b> Advantage and disadvantage of frequency analysis - Time concept of frequency response - Plotting of frequency response - Frequency response specification - Phase margin - Gain margin - Bode plot phase margin and gain margin of bode plot.
4-15	<b>Nyquist stability analysis</b>
16-17	<b>Design of control system</b> Design of control system from frequency response - Lead compensator - lag compensator - lead-lag compensator.
18	<b>Sample and hold systems</b>
19	<b>Jury stability criterion</b>
20	<b>Implementation of digital controllers</b>
21-23	<b>Tunable PID controllers</b>
24-25	<b>Linear versus nonlinear systems</b>

26	Describing function analysis
27	Common nonlinearities
28	Analysis of non-linear systems using phase plane technique
29	Nonlinear control system design problem
30	Structure controller and sliding control
<b>Practical syllabus</b>	
1	Open & Closed loop systems
2	Simulink Overview
3-4	Time response of First order system
5-6	Time response of First order system Using M-FILE
7-8	Residues value of First order system
9-10	Error steady state
11-12	Practical applications of 1 <sup>st</sup> order system
13-14	Time response of 2 <sup>nd</sup> order system
15-16	Characteristics of 2 <sup>nd</sup> order system
17	Time response Using M-FILE
18-19	Error steady state to 2 <sup>nd</sup> order system
20-21	Pode plot of 2 <sup>nd</sup> order system
22	Analog communications system using Simulink
23	Digital communications system using Simulink
24-25	Nyquist theorem to 2 <sup>nd</sup> order system
26-27	Practical applications to 2 <sup>nd</sup> order system USING Simulink.
28-29	PID controllers
30	Sliding controllers

**Recommended Books:**

## Text Books:

- Feedback Control Systems by philips and Harbor (3<sup>rd</sup> Edition).
- Digital Control and State variable methods: Conventional and Intelligent control systems, by M.Gopal, Tata McGraw Hill, 3<sup>rd</sup> Ed., 2009.

## Reference Books:

- Modern Control System by Richard C. Dorf (5<sup>th</sup> Edition).
- Control Sytem Design using MATLAB by Bahram Shahian & Michael Hassul.
- User's Guide for The Student Edition of MATLAB by Duane Hanselman & Bruce Littlefield.
- H. K. Khalil, 'Nonlinear Systems', Prentice Hall, 3<sup>rd</sup> Ed., 2002.
- S.Sastry, 'Nonlinear Systems: Analysis, Stability and Control', Springer, 1999.

**Subject Number: UREQ 364****Subject : Technical Writing and presentation Skills, International Relations.****L T P C****1 0 0 2**

Specific Objectives of course:

To introduce the complex and ever-changing geo-political environment through a study and analysis of the behavior of nation states in the contemporary international states system.

Also enhancement of language skills and development critical thinking.

**Theoretical syllabus**

Week	Contents
1-3	<b>Presentation skills</b>
4-8	<b>Essay Writing:</b> Descriptive - Narrative - Discursive - Argumentative.
9-11	<b>Academic Writing:</b> How to write a proposal for research paper/ term paper - How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)
12-13	<b>Technical report Writing</b>
14-15	<b>Progress Report Writing</b>
16-20	<b>The new realities after the 9/11 emphasized new geo-political dimensions of the international relations.</b>
21-25	<b>The old concepts have been replaced by the new ones to cater for the complex and ever-changing global geo-political environment.</b>
26-30	<b>Apart from the basic concepts of the subject, some current issues such as new world order, terrorism, Iraq crisis, Afghanistan problem, ISIS grwoing and its effects on the people and indo-pak dialogue, have also been introduced in the syllabus which makes it more relevant and updated for the students.</b>

**Reference Books:**

- Writing. Advanced by Ron White. Oxford Supplementary Skills. Third mpression 1992. ISBN 0194354073 (particularly suitable for discursive, discursive, argumentative, and report writing).
- College Writing Skills by John Langan. McGraw-Hill higher education 2004.
- pattern of College Writing (4th edition) by laurie G. Kirszner and Stephen R. Mandell. St. Martin's Press.
- The Mercury Reader. A Custom Publication. Compiled by nother Llinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and maurice Scharton. ( A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students.

**Awsat Technical University**

Sl. No.	Code	Course Type	Course Title	L	P	T	C
1	AVTE 4110	Core	Avionics System Design & Instruments	2	2	4	6
2	AVTE 4111	Core	Analog& Digital Integrated Circuits FPGA-Based System Design	2	2	4	6
3	AVTE 4112	Core	Aircraft Radar and Microwave	2	2	4	6
4	AVTE 426	Core	Aircraft Data Networking	2	2	4	6
5	CREQ 448	Core	Final Project	0	6	6	6
6	AVTE 419	Core	Power Electronics	2	2	4	6
7	CREQ 449	Secondary	Industrial Engineering	2	0	2	4
8	UREQ 465	General	Professional & Social Ethics Leadership	2	0	2	4
Total				14	16	30	44
The perce. of core hours = 87%				The perce. of theoretical hours = 47%			
The perce. of secondary hours = 7%				The perce. of practical hours = 53%			
The perce. of general hours= 6%							

**Subject Number: AVTE 4110****Subject : Avionics System Design & Instruments.**

L T P C

2 0 2 6

Objective of the course:

To cover the essential ingredients of avionics system design including data buses, displays and power systems with emphasis on aircraft interfaces and avionics system architecture and fitting of avionics systems into aircraft as well as the integration of avionics system hardware and software. To gain an insight into the concepts of measurements methods, direct or indirect and essential to appreciate the problems associated with instrumentations, learn basic characteristics, source of errors constructions, transduction principles of sensors & transducers employed in measurements of various non-electrical parameters commonly encountered in almost every branch of engineering

**Theoretical syllabus**

Week	Contents
1	Importance and role of avionics
2-3	Display and man-machine integration
4-5	Aerodynamics and aircraft control
6	Fly-by-wire flight control
7	Air data and air data systems
8-9	Autopilots and flight management systems
10-11	Avionics interfaces: Data buses - Crew displays - Power - Maintenance - Physical interfaces.
12-13	Avionics system integration Data bus system - Integrated modular avionics - Commercial off-the-shelf (COTS).
14	Unmanned air vehicles
15	Doppler and altimeter radars - Mapping and multimode radars
16-17	Units & dimensions, dimensional analysis.
18-20	DC bridge methods, AC bridge methods
21-25	Sensors & Transducers Classifications - Resistance - Reactance change transducers - Potentiometric transducers - RTDs - Thermostats - Hot-wire anemometer - Strain-gauge - Inductive-type transducers - Thermoelectric transducers - Semiconductor sensors - Piezoelectric sensors - Ultrasonic sensors - Photo sensors.
26-30	Instruments Analog instruments - electro dynamometer type instruments - Induction type instruments Digital instruments - interfacing signals
<b>Practical syllabus</b>	
1-15	Determined by the department depending on assigned to the students and appropriate for laboratory facilities available.
16-30	Determined by the department depending on assigned to the students and appropriate for laboratory facilities available.

**Recommended Books:**

Text Books:

- Introduction to Avionics Systems by R. G. Collinson (2<sup>nd</sup> Edition).
- Avionics Navigation Systems by Myron Kayton and Walter R. Fried.
- Principles of Electronic Instrumentation & Measurements by Howard Berlin and Frank Gaetz.
- Modern Electronic Instrumentation & Measurements Techniques by William D. Cooper.

Reference Books:

- Aircraft Electricity & Electronics by K. Eismen. MC Graw Hill. 1994.

**Subject Number: AVTE 4111****Subject : Analog & Digital Integrated Circuits, FPGA-Based System Design****L T P C****2 0 2 6**

Objectives of Course:

To provide an insight into analysis and design of analog electronic circuits emphasizing amplifiers that find extensive application in computer, control systems, digital instrumentation, communications & radar, etc. In addition to, learning the design of digital electronic circuits with Field Programmable Gate Arrays.

**Theoretical syllabus**

Week	Contents
1-2	Differential amplifier in both its bipolar and FET forms.
3	Various output stages
4-5	Frequency response of amplifiers
6-7	Feedback analysis with focus on practical circuit applications of negative feedback
8	Stability problems in feedback amplifiers
9	Introduction to analog integrated circuits (bipolar and MOS) leading to analysis of a 741 operational amplifier
10-11	Design of filters
12-13	Tuned amplifiers
14-15	Oscillators
16-17	<b>Introduction:</b> Digital design and FPGA - FPGA-based system design - Manufacturing process
18	Transistor characteristics - CMOS logic gates - wires - Registers and RAM - Packages and pads
19	FPGA architectures - SRAM-based FPGAs
20	Permanently-programmed FPGAs
21	Circuit design of FPGA fabrics -Architecture of FPGA fabrics
22	Logic design process
23	Combinational network delay
24	Power and energy optimization
25	Arithmetic logic elements - Logic implementation using FPGAs
26	Physical design (PnR) for FPGAs
27	Synthesis process
28-30	Sequential design using FPGAs, sequential machine design process, sequential design style, FSM design, ASM design.

**Practical syllabus**

1	Effects of emitter degeneration on gain and frequency response of a BJT differential amplifier
2	Lower/upper 3-dB frequencies
3	Mid-band gain
4	Bandwidth of a BJT amplifier with various feedback technologies
5	Performance analysis and optimization of a two stage amplifier with various feedback technologies
6	Class-A output stage design using emitter-follower configuration
7	Class-B and AB output stages using complementary pair of transistors
8	Gain and frequency response of 741 operational amplifier



9	Layout of 741 on ORCAD using discrete components
10	Component selection and simulation of 741 on Pspice
11	PCB manufacturing of 741 Operational Amplifier
16	Introduction to Verilog HDL
17	Gate-level modeling
18	Data flow modeling
19	Behavioral modeling, design, simulation.
20	Synthesis and fitting of combinational circuits
21	Design and implementation of an FSM and memory.

**Recommended Books:**

- FPGA-Based System Design, by Wayne Wolf, 2004, Prentice Hall, ISBN: 0131424610.
- Verilog HDL, by Samir Palnitkar, Second Edition, 2003, Prentice Hall, ISBN: 0130449113.
- Advanced Digital Design with the Verilog HDL, by Michael D. Ciletti, First Edition, 2003, Prentice Hall, ISBN: 0130891614.
- Microelectronic Circuits By Adel S. Sedra & Kenneth C. Smith
- Analysis and design of Analog Integrated Circuits By Grey and Meyer.

**Subject Number: AVTE 4112****Subject : Aircraft Radar and Microwave****L T P C****2 0 2 6**

Objectives of Course:

To provide an introduction to the fundamentals of radar systems with emphasis on pulse radar, CW, FMCW, MTI, MTD, target tracking, radar performance in active environment, ESM, ECM, and ECCM at system level.

**Theoretical syllabus**

Week	Contents
1	<b>Introduction to Radar System:</b> Natural of radar and applications - What it can do?.
2	<b>Basic radar equation and important factors</b>
3	<b>Basic concepts of probabilistic detection used to analyze the performance of radar.</b>
4	<b>Principle and applications of CW and FMCW radar.</b>
5	<b>Basic concepts of analog/digital MTI.</b>
6-7	<b>Adaptive MTI and pulse Doppler radar.</b>
8-9	Airborne Radar - Space borne Radar - Synthesis aperture radar - SHAR and MST radar.
10-12	<b>Various tracking radar techniques</b> Object identification and tracking- Optical flow techniques - Hybrid technique
13-15	<b>Electronically steered phased array antenna and side lobe cancellation - Radar performance in wartime environment and electronic warfare - Basic principles of electronic support measures - Noise jamming - Frequency agility - Stealth technology and deceptive/expandable ECM</b>
16-19	<b>Introduction to microwave communication system, microwave spectrum, advantages and applications of microwave system.</b>
20-23	<b>Waveguide:</b> WG characteristics - Circular and rectangular WG, Passive and active microwave devices including solid state devices - Klystron - Magnetron - TWT and Twystrons as microwave oscillator and amplifier
24-28	<b>Microwave components and semiconductors - Microwave cavities - Directional coupler - Hybrid circuit - Circulators and isolator</b>
29-30	<b>Microwave telecommunication system architecture of the networks -Radar system.</b>

**Practical syllabus**

1-2	Basic Pulse Radar range and range resolution measurements
3	Radar cross section area of different types of target
4-5	CW and FMCW radar
6	Pulse Doppler radar with MTI and MTD
7-8	Sequential Lobing and mono-pulse target tracking radar
9	Electronically steered phased array antenna radar
10	Spot noise jamming and Burn-through range
11	Frequency agility and barrage noise jamming
12	Range gate pull off and angle detection jamming (Deceptive ECM)
13-15	Variable density Chaff cloud (Expendable ECM) against tracking radar.
16-17	Waveguide wavelength and VSWR for different loads
18-19	Properties of an isolator
20-21	E-plane & H-plane TEE junction
22-23	Magic Tees
24-25	Coupling and Directivity of a directional coupler

26-27

Measurement of normalized impedance of unknown load.

Rec

**Recommended Books:****Text Books:**

- Introduction to radar System, by M. Skolnik. 2<sup>nd</sup> Edition.
- Microwave Devices and Circuits By Samuel Y. Liao.
- Pasive and Active Microwave Circuits by J. Helszajn

**Reference**

- Understanding Radar Systems by Simon Kigsley and Shaun Que.
- Electronic Communication System by George Kenned.

**Subject Number: AVTE 426****Subject : Aircraft Data Networking**

L T P C

2 0 2 6

Objective of course:

Learn the student concepts of computer networks through its types, systems and protocols used.

**Theoretical syllabus**

Week	Contents
1	<b>Networks:</b> Overview and important concepts - Network categories (PAN, LAN, MAN, WAN, GAN) - Circuit switching vs. Packet switching - Baseband vs. Broadband transmission - Transmission modes (simplex, half duplex, full duplex) - Segments and backbones - Peer to Peer vs. Client/Server Networks - Protocols (elements, functions) - Transfer Rate (Digital BW, Throughput, Goodput).
2-3	<b>Networking Models:</b> OSI reference model (Layer1: Physical Layer, Layer2: Data-link Layer, Layer3: Network Layer, Layer4: Transport Layer, Layer5: Session Layer, Layer6: Presentation Layer, Layer7: Application Layer) - TCP/IP model (Network access layer, Internet layer, Transport layer, Application layer).
4-5	<b>Physical Layer:</b> Mediums [Copper( Coaxial cable, Twisted Pair Cables), Fiber Optics (multimode, singlemode) - Wireless (RF, Microwaves, satellites, IR, FSO)] - Networking topologies (Bus, Ring, Dual Ring, Star, Extended Star, Mesh, Wireless) - Physical vs. logical topologies. Noise (Cross talk, thermal, AC power noise, reference ground noise, EMI/RFI) - Losses (Copper medium losses, Fiber optics losses) - Timing issues (Dispersion, Jitter, Latency) - Coding [Liner coding (NRZL, NRZI, Manchester, Differential Manchester, MLT3) - Block coding (4B/5B, 8B, 10B)] - Layer1 Devices (Repeaters, Hubs)
6-11	<b>Data-link layer protocols:</b> Ethernet (IEEE 802.3) [ Regular Ethernet (mediums, topologies, encoding), Fast Ethernet (mediums, topologies, encoding), Gigabit Ethernet (mediums, topologies, encoding), 10Gigabit Ethernet (mediums, topologies, encoding), frame format, Data-link Sublayers (MAC, LLC), CRC, MAC addresses (unicast, multicast, broadcast), MAC mechanism (CSMA/CD)]. Token Ring(IEEE 802.5) [Physical layer specifications (mediums, speeds, topologies, encoding), Frame types and Formats(Data Frame, Token Frame, Command Frame, Abort Delimiter Frame), Priority and reservation, MAC mechanism (Token passing)]. Fiber Distributed Data Interface FDDI [Physical layer specifications(mediums, speeds, topologies, encoding), Frame types and Formats(Data Frame, Token Frame, Station management Frame), MAC mechanism (Early Token Release)]. Data-link layer protocols (continued):WiFi (IEEE 802.11) [Physical layer specifications(topologies, FHSS, DSSS, OFDM, architecture, speeds), Versions (legacy, IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, IEEE 802.11n), Frames Formats, MAC mechanism (CSMA/CA)], Bluetooth (IEEE 802.15) (architecture, format, layers)
12	<b>Layer2 Devices :</b> NIC - Ethernet Bridge (collision domains, broadcast domains, transparent bridging) - Ethernet Switches, Access point.
13-20	<b>Network Layer:</b> IPv4 [Datagram format, fragmentation, classfull addressing ( subnetting, supernetting ), classless addressing]. IPv6 (datagram format, addressing extension headers, tunneling). ICMP(messages, format, error reporting, queuing) - IGMP (group management,

	messages, format, error reporting) - ICMPv6(messages, format, error reporting). ARP - DNS (Name Space, Resolution, Messages) - NAT. Routing [ routing tables, static routing, Dynamic routing, unicast routing, multicast routing, Protocols (RIP, OSPF, BGP)].
<b>21-23</b>	<b>Transport Layer:</b> UDP (format, port numbers, sockets) - TCP ( format, port numbers, connection establishment and connection termination, flow control, error control, congestion control) - SCTP ( format, flow control, error control, congestion control) - QoS ( Flow characteristics, flow classes).
<b>24-26</b>	<b>TCP/IP application layer protocols:</b> e-mail ( SMTP, POP3) - File transferring (FTP) - Web (HTTP, HTML, XML) - VoIP (RTCP, SIP, H323) - Management (SNMP).
<b>27-28</b>	<b>Security:</b> Encryption - Viruses - Hacking - Firewalls - VPNs - IPsec - SSL - WEP - WAP.
<b>29-30</b>	<b>WAN:</b> Protocols (PPP, PDN) - Systems (ATM, SONET , ISDN, DSL).
<b>Practical syllabus</b>	
<b>1</b>	NIC installation
<b>2-3</b>	Cat 5e cabling, cross and straight through
<b>4</b>	Pear to Pear 2- PC Network
<b>5</b>	LAN via Switches, Extended star LAN
<b>6</b>	Sharing (folders, drives)
<b>7</b>	Sharing Printers
<b>8</b>	Remote Desktop Connection
<b>9-10</b>	Privileges and Security in Win XP
<b>11</b>	Ad hoc WLAN
<b>12</b>	Infrastructure WLAN via AP
<b>13-14</b>	AP as (Client, PTP bridge, PTMP bridge)
<b>15-16</b>	WLAN security (MAC filtering, WEP, WAP)
<b>17</b>	Routers
<b>18-19</b>	Subnetting (Class A, Class B, Class C)
<b>20-21</b>	Utilities (ping, Ipconfig, telnet, traceout, nslookup)
<b>22</b>	Internet Connection Configuration and Sharing
<b>23-26</b>	Web Site Design (HTML, ASP)
<b>27</b>	Win Server 2003 Installation
<b>28-30</b>	Administration and configuration of Win Server 2003

Rec

**Recommended Books:****Reference**

- Data communications and Networking, 4th Edition, by Behronz A. Foruzan
- TCP/IP Protocol Suit 4th Edition, by Behronz A. Foruzan.

<b>Subject Number: AVTE 419</b> <b>Subject : Power Electronics</b> <b>L T P C</b> <b>2 0 2 6</b>	
Objective of the course: It is aimed to design and analysis the electronic devices that used with power electrical.	
<b>Theoretical syllabus</b>	
Week	
<b>1-4</b>	<b>Power electronics systems</b> Introduction - History of power electronics - Power electronics semiconductor device - Power electronics converter - Advantage and disadvantage - Power electronics module - Computer simulation of power electronics circuit- Basic structure of power diode - IV characteristics of power diode - Reverse recovery - Power diode types (general purpose, fast switching and sckootky diodes) - Effect of forward and reverse recovery time of diode - Series and parallel connection of diodes - Diodes and rectifier circuit (half wave and full wave).
<b>4-6</b>	<b>Power transistor</b> Power MOSFET - PMOSFET characteristics - Application - Comparison MOSFET and BJT - Insulated Gate BJT - IGBT structure - Equivalent circuit - Operation - Application.
<b>7-12</b>	<b>Thyristor principle and application</b> Basic structure of thyristor - IV characteristics - Two transistor model of thyristor - Turn ON and turn OFF characteristics - Thyristor gate characteristics - Thyristor protection circuit - di/dt protection circuit - dv/dt protection circuit - Snubber circuit design - Gate protection circuit - Heating - Cooling and mounting of thyristor - Gate triggering circuit - Pulse transformer - Photocoupler circuit - Thyristor commutation circuit - Natural commutation - Forced commutation - Load side - Resonant pulse - Complementary - Impulse - External pulse - Line side commutation circuit - Series and parallel connection of thyristor - Thyristor types - Phase controlled - Fast switching - Gate turnOFF- Bidirectional switch - Reverse conduction - Static induction - Light activated - FET-controlled - MOSFET controlled and other thyristor family - Programmable unijunction transistor (PUT) - Silicon unilateral switch (SUS) - Comparison between thyristor and transistor.
<b>13-16</b>	<b>Controlled rectifier:</b> Controlled technique, principle of phase controlled rectifier - Single phase half wave rectifier (resistive and resistive-inductive )load - Single phase half wave rectifier (resistive and resistive-inductive )load with freewheeling diode - Single phase full wave rectifier (resistive and resistive-inductive )load - Single phase full wave rectifier (resistive and resistive-inductive )load with freewheeling diode.
<b>17-19</b>	<b>Inverter</b> Introduction to inverter and application - Classification of inverters - Voltage source inverters - Current source inverters - Square wave inverters - Quasi square inverter - Pulse modulation inverters - Thyristor in inverters - Single phase half bridge inverters - (resistive and resistive-inductive load) - Single phase full bridge inverters (resistive, resistive-inductive) load - Performance parameter of inverters.
<b>20-21</b>	<b>Choppers</b> Introduction to chopper- Basic classification of chopper - Basic operation - Thyristor chopper circuit - Performance parameter.
<b>22-24</b>	<b>Voltage controller:</b> Introduction to voltage controller - Principle of ON-OFF control - Principle of phase control - Single phase bidirectional controller with resistive load - Single phase controller with resistive-Inductive load.

<b>25-27</b>	<b>Charge transport in semiconductor:</b> Drift current - Hall effect - Current density equation - Scattering mobility of carrier - Effect of electric field on mobility - Temperature effect on mobility - Effect of doping on mobility - Conductivity equations - Diffusion phenomena - Diffusion length - Diffusion in solids - Einstein's relation - Point defects.
<b>28-30</b>	pulse-width-modulated (PWM) inverters; UPS; types of converters; switched mode power supplies, AC and DC motor drives.
<b>Practical syllabus</b>	
<b>1-2</b>	<b>Characteristics of thyristor</b>
<b>3-4</b>	<b>Trigger thyristor by A.C current</b>
<b>5-6</b>	<b>Trigger thyristor by D.C current</b>
<b>7-8</b>	<b>Half- wave rectifier of (RL) without freewheeling diode</b>
<b>9-10</b>	<b>Half- wave rectifier of (RL) with freewheeling diode</b>
<b>11-12</b>	<b>Full- wave rectifier of thyristor</b>
<b>13-14</b>	<b>Trigger traic by A.C current</b>
<b>15-16</b>	<b>Trigger traic by D.C current</b>
<b>17-18</b>	<b>A stable Multivibrator (AMV)</b>
<b>19-20</b>	<b>Monostable Multivibrator (MMV)</b>
<b>21-22</b>	<b>The light newsmen by (555)</b>
<b>23-24</b>	<b>Square wave generator by (555)</b>
<b>25-26</b>	<b>A stable Multivibrator with large time</b>
<b>27-28</b>	<b>Circuit of logic test</b>
<b>29-30</b>	<b>Square wave generator by NAND gate</b>

**Recommended Books:**

- Cyril W. Lander, "Power Electronics," Third Edition, 1993, McGraw-Hill UK, ISBN: 0077077148.
- Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications," Third Edition, 2004, Prentice Hall, ISBN:0131011405.
- Ned Mohan, William P. Robbins and Tore M. Undeland, "Power Electronics: Converters, Applications and Design," Media Enhanced, Third Edition, 2003, John Wiley & Sons, ISBN:0471429082.

**Subject Number: CREQ 347****Subject : Industrial Engineering**

L T P C

2 0 0 4

## Objectives of Course:

To learn the student about projects managements techniques through feasibility studying Efficiency considerations in the use of production requirements to solve the problem.

Week	Contents
1-2	<b>Preview</b> - Construction the frequency distribution - Representation the data in Histogram - Frequency polygon and ogive - Measures of location and measures of variation
3-6	<b>Tests of statistical hypotheses</b> - The nature of a statistical hypothesis - Two types of errors and tests about the mean of a normal distribution - Tests about the mean of a normal population when $\sigma^2$ unknown - Tests about the mean of abnormal population - Tests about the difference of two proportions - and tests about the difference of two means
7-10	<b>Analysis of variance (ANOVA)</b> - One- way analysis of variance with different sample sizes - Two- way analysis of variance
11-12	<b>Linear programming (L.P.)</b> - Definition of the L.P. - Forms of L.P. (general , canonical and standard ) - Formulation of the mathematical model of the L.P. - Solving the mathematical model using a graphical and simplex methods - Solving the mathematical model using M-technique and two- phase method
13-15	<b>Transportation and Assignment models</b> - Finding the starting solution using northwest corner method - Least cost method - Vogell's approximation method (VAM) and Russel's approximation method (RAM) - Finding the optimal solution using stepping stone and multipliers methods - Solving the assignment models in maximized or minimized
16-17	<b>Network planning</b> Graph the network and find the critical path (CP) ; and the program evaluation and review technique (PERT) - Crashing the normal duration to execute the project with least costs
18-19	<b>Sequencing models</b> - Processing n jobs through one machine ( shortest and largest processing time Spt and Lpt ) - processing n jobs through two machines - Processing n jobs through m machines - processing n jobs through two machines with randomly technical routes
20-21	<b>Replacement and maintenance models</b> - Using the average total cost as a criterion to determine the period of replacement the machines - Cost of individual replacement for items of machines - Average cost group replacement per period as a criterion to determine the optimal replacement (individual or grouped ) - Maintenance model
22-23	<b>Inventory models</b> - General inventory model - Static economic order quality (EOQ) models ; EOQ with price break ; and multi - item EOQ with storage limitation - Probabilistic EOQ model - Single - period models ; and multi period model
24	<b>ISO</b> - Total quality management (TQM) - ISO:9000
25-27	<b>Quality control</b> - Acceptance sampling - Calculation the OC-curve for single sampling schemes - rectifying schemes - double sampling schemes - and sequential sampling - Process control and control charts ( X -chart , R-charts , $\sigma$ -charts and P-charts) - Quality level



	- Sampling plans ( single , double and multiple )
<b>28-30</b>	<b>Reliability</b> - Reliability - Failure functions - Mean time to failure MTTF - Variance - Hazard rate function - Conditional reliability - Exponential and Weibull reliability functions - Reliability of system with serial and parallel configuration - Combined series – parallel system and high –level and low – level redundancy

**Recommended Books:**

- Industrial Engineering Mangement by A. Verma, Katson-India.

**Subject Number: AVTE 4110****Subject : Professional & Social Ethics and Leadership**

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**Objectives of Course:**

Teach the ethical issues of interest to the professional community to produce engineers who are not only good and responsible engineers, but also good and responsible citizens. In addition to, introducing the subject of leadership with emphasis on various theories, indicators, functions, responsibilities, qualities, and principles of effective leadership.

Week	Contents
1-15	This course introduces contemporary and controversial ethical issues facing the professional community. Topics include moral reasoning, moral dilemmas, law and morality, equity, justice and fairness, ethical standards, and moral development. Upon completion, students should be able to demonstrate an understanding of their moral responsibilities and obligations as members of the workforce and society.
15-30	Leadership being a task of great responsibility, demands courageous, selfless and devoted behavior. Definitions, theories, concepts, and indicators of effective leadership. Various individual - leader-task - team maintenance function. Traits - responsibilities - qualities - principles and approaches of leadership.

**Recommended Books:**

- TBusiness EthicsT: T Ethical Decision Making and CasesT, by C. Ferrell, John Fraedrich and Linda Ferrell, Sixth Edition, 2005, Houghton Mifflin Company, TISBN: 0618395733:
- Ethics in Engineering, by Mike W. Martin and Roland Schinzinger, Fourth Edition, 2005, McGraw-Hill, ISBN: 0072831154.