# DEPARTMENT OF ELECTRONICS (UNIVERSITY OF PESHAWAR)

Syllabus for M.Sc Electronics

(Conventional)



# **UNIVERSITY OF PESHAWAR**

# PAKISTAN

### Revised M.Sc Syllabus (2013)

### Course Breakup of MS.c Electronics (Previous)

Paper No.	Title of course	Marks
1.	Applied Mathematics	100
2.	Analog Electronics	75
3.	Digital Logic Design & Microprocessor	
	Architecture	75
4.A.	Solid State Electronics	50
4-B.	Electromagnetic Theory	50
5.A.	Computer Language C++	35
5-B.	Computer Net working	40
	Practical I Analog Electronics -	25
	Practical II Digital Logi Design -	25
	Practical III Computer Language -	15
	Practical IV Net Working -	10
	Total Marks for M.Sc. Previous =	500

# Course Breakup of M.Sc. Electronics (Final)

Paper No	Title of Course	Marks
6.	Electronics Communication	75
7.	Control System	75
8. A	Laser	35
8. B	Fiber Optics	40
9.	Industrial Electronics & PLC Programming	75
10.	Microprocessor and Microcontroller Interfacing	75
11.	Project	100
	Practical V Electronic Communication &	25
	Practical VI Control System	25
	Practical VII Laser	15
	Practical VIII Fiber	10
	Practical IX Industrial Electronics & Software En	ng 25
	Practical X Microprocessor/Microcontroller	25
	TOTAL MARKS for M.Sc Final:	600

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## Paper-1

### **Applied Mathematics**

#### Matrix Theory:

Elementary of matrices, system of linear equations, matrix differential equations, bases and dimensions, eigen value and eigenvectors of matrices, diagonalization.

#### **Complex Variables**:

Euler representation, function of a complex variable, analytic functions, cauchy Riemann conditions, Elementary function, Taylor and laurent series, complex integration, Cauchy's theorem and residue calculus.

#### Linear Transform Theory:

Laplac Transform of simple functions, derivatives and differential equations, inverse Laplace Transform, Laplace Transform theorems, S-plane analysis.

#### **Fourier Series:**

Drichiet conditon, odd and even functions, Fourier theorem, representation of periodic signals and linear systems, Parseval inequality, amplitude and power spectra of signals.

Fourier Transform (FT) Frequency analysis and periodic functions, Fourier and inverse Fourier transform, Fourier transform theorems, special F.T, application of F.T to communication, filter and noise.

#### **Probability:**

Introduction to probability sample space and events, finite probability spaces, condition probability.

**Numerical Analysis:** Roots of polynomials, solutions of linear algebraic equations, numerical differentiation and integration, interpolation, solution of ordinary differential equations, modified Euler method, Runge Kutta method, error analysis and stability.

**Z-Transform**: Difference equations, definition of Z-transform, ideal sampler and sampling theorem, mapping from s-plane to z-plane, z-transforms of functions, inverse z-transforms, theorem on z-transform, applications.

#### **Recommended Books:**

- 1. kryszic, E. "Advanced Engineering Mathematics", Tenth Edition John Wiley and Sons, New York, 2011.
- 2. Thomas and Finnie. *Calculus*

### Paper-II

### **Analog Electronics**

(Linear Circuit Analysis and Design)

#### 1. Review (pre-requisite):

Fundamentals of lumped networks, circuit elements, voltage and current source, Active and passive elements, linear and non-linear elements.

#### Basic circuit analysis:

Laws and theorems of circuit analysis and their application to D.C. and A.C. circuits, Circuit transients, T and  $\Pi$  transformation, Basic concepts: semiconductor diodes and transistors and their biasing in CE, CC and CB modes, D.C. and A.C. load lines, hybrid parameters and equivalent circuit, operational amplifiers.

#### **Advance Circuit Analysis:**

Solution to network problems (Steady state and transient using) Laplace Transform, Two-port network (4-Terminals) functions, transfer function, impulse and step responses, time and frequency domain analysis, frequency response of two-port circuit, Bode diagram, analog filters analysis and design techniques.

#### Diodes as circuit elements in:

Half and full wave rectifiers, voltage regulators, current regulators, filters, power supplies.

#### **Amplifier:**

Small signal and large signal amplifiers: analysis and design, coupling of amplifiers (Cascaded), Feedback amplifiers, Special amplifier: Pulse amplifier, DC amplifier, Differential amplifier, Darlington amplifier.

#### **Oscillators:**

Principles, Sinusoidal Oscillator and Various Types of Oscillator Circuits, Resonance Circuits Oscillators, Non sinusoidal Oscillators, Relaxation Oscillators, Blocking Oscillator and Multi Vibrators.

#### **Power Amplifiers:**

Principles of operation, distortion, class A, class B, class AB, Push-pull, power transistor and heat sinking.

#### Feed Back:

Principles, feedback amplifiers, pole analysis and compensation, Head Compensation Stability and noise.

#### **Books Recommend:**

- 1. Analysis of linear circuits by Clayton R Paul, McGraw Hill, 1989.
- 2. Circuit and signals: An Introduction to linear interface Circuit by Roland E. Thomas & Albert J. Rosa, Johan Wiley, 1984.
- 3. Elementary Linear Circuit Analysis by Leonard S. Bobrow, Holt saunders int. Edition, 1981.
- 4. PC Assisted Linear Circuit Analysis and Design by Lan Sinclair, Newnees, 1993.
- 5. Introduction to linear Electrical Circuits for Electronics by M.C Kelley and B. Nichols, John Wiley, New York, 1988.
- 6. Computer Assisted Networks and system Analysis by E.J. Mastascusa, John Wiley, New York, 1988.
- 7. Electronics fundamentals by Thomas L.Floyd, Maxwell Macmillan international 1991.
- 8. Electronic Circuit Handbook, Michael Tooly, 2nd Ed, Newness, 1995.
- 9. Essential of Communication Electronics by Morris Sluzberg William Osterheld, MecGraw Hill Publishing Co, 1989.
- 10. Application Design With Analogue Integrated Circuits by A.W.Scott, 1993.
- 11. Introduction to Operational Amplifiers by J.Y. Wait, McGraw Hill, 1992.
- 12. Introduction to Electronics Design by F.H Mitchell Sr. Prentice Hall, 1988.

# Paper-III

# Digital Logic Design & Microprocessor Architecture

#### Part-A Digital Logic Design

**Digital concepts:** Number Systems, binary arithmetic, binary codes, parity, error detection and correction.

**Combinational logic:** Pulsed operation and trouble shooting of gate networks, applications combinational logic in different logic functions and their trouble shooting.

Flip-flops and related devices: Operating characteristics, basic applications and trouble shooting.

**Counters:** Different types of counters, design of sequential circuits, applications and trouble shooting of counter circuits, symbols and dependency notations.

Shift Registers: Different types of shift register, their application and trouble shooting, symbols and dependency notations.

**Memories and Programmable Logic Devices:** Memory concepts, types of memory, Programmable Logic Devices, testing and trouble shooting.

**Integrated Logic Circuit Technologies:** Basic operational circuit parameters, data sheet interpretation, TTL circuits, practical considerations in the uses of TTL, CMOS circuits, comparison of CMOS and TTL characteristics, interfacing logic families, ECL circuits, I<sup>2</sup>L circuits, PMOS and NMOS.

#### Laboratory:

Construction of logic gates using discrete components, study of characteristics of digital integrated circuits, design and construction of different types of combinational circuits like half adders, full adders, parallel binary adders, look ahead carry adders, comparators, decoders, encoders, multiplexers, demultiplexers,

Parity generators/checkers, different type of sequential circuits and their troubleshooting. Design, construction and study of different types flip-flops and their troubleshooting. Comparatives study of digital ICs of different technologies and their mutual interfacing.

#### **Recommended Books:**

1. Floyd, T. L: "Digital Fundamentals", 4th Ed, Macmillan, New York, 1990.

2. Mano, M. M: "Digital Logic and Computer Design", Prentice-Hall, Englewood Cliffs, N.J. 1979.

3. Louis Nashelsky: "Introduction to Digital Technology", 3rd Ed.

4. Bartee, T. C: "Digital Computer Fundamentals", 6th Ed., Mcgraw-hi11, New York, 1985.

### Part-B

### **Microprocessor Architecture**

Sequential Machines: Registers, ALU, control word, generation of control word, control section, register section, Bus organization.Microcode, Instruction set, Hard-wired control and Microprogrammed control, branching info, Address generation logic. Microprogramming of important Assembly instructions, the FETCH-EXECUTE cycle. SAP Series (Simple as Possible Computers: Hardware Architecture and Software Programming of:

- 1. SAP-1 Simple as possible Computer 1
- 2. SAP-2 Simple as possible Computer 2
- 3. SAP-3 Simple as possible Computer 3

#### **Recommended Books**

 Mano, M. M. "Computer System Architecture",2nd Ed., Prentice-hall, Englewood Cliffs, N. J., 1982.
Mano, M. M. "Digital Logic and Computer Design", Prentice-hall, Englewood Cliffs, N.J., 1979
Money, S. a.: "Microprocessors in Instrumentation and Control", Collins, London.

## Paper-IV A

### **Solid States Electronics**

Introduction to Basic Quantum Mechanics, Particle in a Box, Kronning\_ Penning Model and Energy Bands in Solids, Semiconductors Statistics, Intrinsic and Extrinsic Semiconductor, Shallow and Deep Impurities, Non \_Degenerate and degenerate Semiconductors, Calculation of Doping Densities and the Fermi Level, Mobility, Conductivity and life Time of Carriers.

The PN Junction: Homo and Hetro \_Junction Devices, Abrupt and Linearly Graded PN Junctions, Current Transport in the PN Junction PIN Diodes, SCR's, DIAC's & TRIAC's.

Transistors: Bi-Polar Junction Transistors, Modes of Operations, Injunctions Efficiency, Gain etc, Transistor Modeling, Frequency Performance, HF Transistors, Metal Semiconductor Contacts, Field Effect Transistors, JFET, MESFET, MOS DIODE, MOSFETS Structures, Frequency Performance of Devices.

Introduction to Fabrication of Semiconductor Devices and Integrated Circuits.

#### **Recommended Books**

1. Physics & Technology of Semiconductor Devices by A .S. Grove Wiley, New York,

1967.

- 2. Solid State Devices by Donard De Cogan Macmillan, 1987.
- 3. Electronic Devices by G. Schultz, Macmillan, 1994.

4. Physical Properties of Semiconductors by Wolfe, Holonyak & Stillman Prentice Hall Cliffs,1988.

- 5. Physics and Technology of Semiconductor Devices by S.M.SZE.Wi1ey, 1985.
- 6. Solid State Electronics by A Barlieve Printice Hall, 1985
- 7. Introduction Semiconductor Materials and Devices by MS Tyagi Wiley New York, 1991.
- 8. Solid State Electronic Devices, 4th Edition by Beng G. Streetman Prentice Hall International , inc, 1995.

4.

### Part IV - B

### **Electro-Magnetic Field Theory**

#### **Review:**

Vector Analysis, Scalars and Vectors, Vector Algebra, Cartesian coordinate system Vector Components and Unit Vectors, Vector Field, Dot Product, Cross Product, Cylindrical Coordinate, Spherical Coordinate System.

Coulomb's Law, Electric Field Intensity, Field due to continuous volume charge, Line Charge and Sheet of charge, Streamlines and sketches of Field.

Electric Flux, Gauss's Law and its Applications, Maxwell First Equation, Vector Operator  $\nabla$  and Divergence Theorem.

Energy and Potential, Line Integral, Potential Difference and Potential, Potential field of a Point Charge, Potential field of a system Charges, Potential Gradient, The Dipole and Energy Density in the Electronic Field. Current and Current Density, Continuity of Current, Metallic Conductors, Conductor Properties and Boundary Conditions, Method of Images, Semiconductor, Nature of Dielectric Materials Capacitance, Several Capacitance Examples, Capacitance of a Two Wire Line.

Bio savart Law, Ampere's Circuital Law, Curl, Stokes Theorem, Magnetic flux and Magnetic flux Density, ScaIar and Vector Magnetic Potentials, Derivation of Steady Magnetic\_ Field Laws. Force on moving Charge, Force on a Differential Current Element, Force between Differential Current Element, Force and Torque on a closed Circuit, Nature of Magnetic Materials, Magnetization and Permeability, Magnetic Boundary Conditions, Magnetic Circuit; Potential Energy and Forces on Magnetic Materials, inductance and Mutual Inductance.

Maxwell's Equations and Plane wave: Faraday's Law, Maxwell's equations in point and integral form, The retarded Potential, Wave motion in free space, Perfect dielectric and Lossy dielectrics, Poynting vector and Power Considerations, Wave propagation in good conductors, Skin effect, Reflection of Waves, Standing Wave ratio.

#### **Recommended Books:**

- 1. Engineering Electromagnetic by W.H. Hayt 5th Edition.
- 2. Electromagnetic by John. D. Krauss.

# Paper-V.A

### Computer Language C++

Introduction to computers and programming, computer Operating system DOS, UNIX, OS/2. Introduction to Windows Environment, Introduction to LAN. **Fundamental of programming:** High Level Languages, Problem Analysis and Algorithm Development. Flow charting, Sequential Flow, Conditional Flow, Repetitive Flow, and Algorithm Logic.

**Introduction to C-Language:** Program structure, pre processor declaration, Looping and flow control in C, Functions and Structure Programming, standard data type, Branching and Nested flow of control, Array and string, pointers, Structure data types and Union, Input/output, Filling system in C, Graphics programming, Object Oriented Programming

#### **Recommended Books:**

1. Computers and programming by Francis Scheid, Schaum's Outline Series, 1983.

- 2. C Programming using Turbo C by Robert Lafore Haward & W.Sams CO, 1990.
- 3. Joy of C by L. H. Miller and A. E Quilici, John Wiley, New York, 1993
- 4. Microsoft Disk Operating System Manual
- 5. C++ complete by Anthony Rudd, John Wiley, New York, 19994
- 6. Understanding UNIX by John, Que. Books, 1990.

7. Computer Organization and Architecture by W.Stalling, Maxwell-Macmillan, NewYork, 1990.

#### Laboratory:

1. To write Programs, e. g. Quadratic equation, Temp Conversion etc.

2. Project etc.

#### Paper V B: Networking

Introduction to Networks, Data Communications principles, Data Signaling Formats Channel Bandwidth and Capacity. The Physical Layer, Noise and Error Detection Methods Queuing Systems. The Continuous Time Discrete Event Process.

The M/G/I Queuing System, Application of the M/G/I Queue Networks of Queues Synchronous Time Division Multiplexing, Frequency Division Multiplexing, Synchronous Time Division Multiplexing, The Data Link Layer and X .25, Routing in Packet Switched Network, Flow and Congestion Control, Multiple Access Communication Protocols, Fixed Assignment Schemes, Random Access Techniques, Centralized Demand Assignment Schemes, Distributed Demand Assignment Schemes. Local Area Network Protocols and Standards. Token Bus, Distributed Queue Dual Bus, Fiber Distributed Data Interface, Network Interconnection through Bridges and Routers. Transport Protocols, Users Datagram protocol, Transport Protocols. Datagrarm protocol, Transport Protocols. Integrated Services Digital Networks (ISDN)

Switching Techniques and Fast Packet Switching. Digital Circuit Switching, Advances in Switching Techniques, Photonic Switching.

#### **Recommended Books:**

- 1. MCSE Networking Essential by J.cusad & Dan New Land.
- 2. Digital Transmission, Systems and Networks by J. M. Miller and S. V. Ahmad, Computer Science Press, Rockville, 1987
- 3. Data and Computer Communication by W. Stallings, Macmillan, New York, 1994.

# Paper-VI

## **Electronic Communication**

Analysis of signals: Periodic signal representation by Fourier series, some properties of Fourier transform, the Sampling theorem.

Signal Transmission. Distortion-less transmission through a linear system, signal distortion over a spectral density, power spectral density of noise.

**Digital communication Systems:** Digital multiplexing, line coding, pulse shaping, scrambling, the regenerative repeater, M-ary communication, digital transmission of analog signals.

**Amplitude modulation:** Baseband and carrier communication, amplitude modulation, DSB-SC, SSB, VSB, Digital carrier systems (ASK, PSK, FSK, etc), interference and noise in AM systems, the superheterodyne AM receiver, television.

**Angle Modulation:** The concept of generalized angle and angle modulation, bandwidth of angle modulated waves, Generation of FM waves, demodulation of FM, interference and noise in angle. Transmission Lines

The ideal transmission line, characteristic impedance, reflection and transmission coefficients, sinusoidal waves on an ideal transmission line with discontinuities, standing wave Ratio.

Behavior of Communication Systems in the presence of Noise: Baseband systems, amplitude- modulated.

#### Laboratory:

Design and study of low-power AM and FM transmitters and receivers. Study of different signals behavior and its analysis-using computer simulated experiments and receivers. Study and construction of different digital communication systems. Multiplexing and Demultiplexing using digital ICs, line coding, design and construction and study of digital carrier systems. Study of TV system, Telephone system, digital switching systems.

#### **Recommended Books:**

1. Lathi, B.P "Modern digital and analog communication systems". 4th Edition. Holt, Rinehart and Winston HRW Series in Electrical and Computer Engineering, New York, 1983.

2. Electronic Communication by Kennedy, McGraw Hill, 1992.

3. Telecommunication Engineering by J. Dudop and D.G.... 3rd Ed, Chapman and hall, London, 1994.

4. Electronic Communication by Robert, Schoenbeck, Maxwell Macmillan International, 1992.

5. Advanced electronic Communication Systems by W. Toms, 3rd Ed. Prentice Hall, 1994

# Paper-VII

### **Control System and Information Theory**

Mathematical Models of Physical Systems, Transfer Functions and System Response, First order and second order Systems, Higher order Systems, Feedback Control Systems, Routh's Method, Root Locus Analysis and Design, Frequency Response Analysis and Design, Nyquist diagram and stability criterion, Bode Diagrams and Analysis, State Space Analysis and Design, analogue Control Systems, Digital Control Using Microprocessors, Computer Controlled systems.

Prerequisite: Systems and Signals Analysis.

#### **Recommended Books:**

Feedback Control system by John Van De Vegte, 3rd. Ed., Prentice\_ Hall, London, 1994.
Digital Control: A State Space Approach by RJ Vaccaro, McGraw Hill, 1995.

3. Control System: Principle and Design by Ernest. O. Doebelin, John Wiley & Sons, New York, 1985.

4. Computer Controlled Systems by K.L.Astrom, B. Wittenmark, Prentice Hall, Englewood Cliff, 1984.

5. Process Control Instrumentation Technology by C. D. Johnson, John Wiley & Sons New York, 1982.

6. Control Systems by N. K. Sinha, CBS Publishing Japan Ltd., New York, 1986.

7. Linear Control Systems Engineering by Morris Driels, McGraw Hill, New York, 1996.

# Paper-VIII. A

#### Laser Theory

**Sources of Radiation:** interaction of radiation with matter, blackbody radiation, principles of laser operation. Pumping processes, passive optical resonators, rate equation approach to laser theory, CW and transient laser behavior, O- switching, types of LASER, LASER detectors.

### Paper VIII B:

### **Fiber Optics**

Introduction to fiber optics, Physics of light, Principles of Fiber optics light propagation, total internal reflection, mode propagation, skew waves, acceptance angle and numerical aperture.

Fiber Characteristics: Fiber losses, Material losses, Scattering, Wave-guide and Microbend losses.

Dispersion: Intermodal dispersion, Interamodal dispersion.

**Optical Fibers:** Step index fiber multi mode fiber, graded index fiber, step index fiber single mode, other fibers, Principles of Fiber Optic Communication, Modulation and Multiplexing, fiber Optics Components.

#### **Recommended Books:**

1. Fiber Optics communication Design Handbook by Robert J. Hoss, Prentice Hall International, Latest Edition

- 2. Laser technology by Jim Johnson. Health Company 1985
- 3. Fiber Optics communication by Joseph c palais, 5th Edition

### Paper-IX

### **Industrial Electronics & PLC Programming**

### Part "A"

Mechanical Devices, Sensors Switches, Operational Amplifiers and other ICs, for industrial Applications, time Delay Circuits, phase and power control circuits .DC and AC Motors, Stepper Motors, Motor Control Circuits, Transducers, Industrial Process Control, Digital Sequences Control, Pulse Modulation in Industrial Telemetry and Data Communication, Segmental Power Control, Programmable Controllers, Automation and Robotics.

#### Part "B"

PLC's VS other types of Control, PLC Architecture, PLC Memory Overview, Memory Organization and I/O Interaction, Scan Cycle, I/O Rack Enclosures and Table Mapping, PLC Instructions for Discrete Inputs, PLC Instructions for Discrete Outputs, Types of PLC Languages, Ladder Diagram Format, Ladder Relay Programming, Timers and Counters Instructions, Program/Flow Control Instructions, Arithmetic Instructions, Special Function Instructions, Introduction to PLC System Selection, PLC Sizes and Scopes of Applications, Siemens LOGO PLC, its Architecture and Programming

#### **Recommended Books:**

- 1. Industrial Electronics by Petrozola McGraw Hill, International Edition, 1996
- 2. Programmable Controllers Theory and Implementation, Second Edition, By L.A. Bryan and E.A. Bryan, 1997, Industrial Text & Video Company
- 3. Industrial Electronics by James T. Humpheries and Leslie P. Sheets, Delmar Pub. Co. US
- 4. Industrial Electronics Design and Applications by Charles A. Davis, Charles Merrill Co.
- 5. Power Electronics by Mohan, Undeland and Robbins, John Wiley, 1994.
- 6. Modern Industrial Electronics by. C.A. Schuler and W. L. McNamee, McGraw Hill, New York, 1993.
- 7. Industrial Electronics and Robotics by Charles A. Schuler and William L. McNamee, McGraw Hill, 1986.
- 8. Robotics by J. L Fuller, Maxell and Macmillan, New York, 1991.

# Paper-X

## Microprocessor and Microcontroller Interfacing

#### Part A: Microcontroller

Microcontrollers, Architecture of Microcontrollers, Timers & Counters. Instruction Set: Moving Data, Logical Operations, and Arithmetic Operation, Jump & Call instructions.Serial Data Communication.

#### **Recommended Books:**

1. Microprocessors and Interfacing by Douglas V. Hall, 2nd Ed. McGraw Hill International

Editions, 1990. 2. Design with Microcontrollers by J.B Peatman, McGraw Hill, New York, 1988.

#### Part B: Microprocessor Interfacing

The 8088/8086 Microprocessors: Pin outs and the Pin Functions, Clock Circuitry, Bus Buffering and Latching, Bus Timing, Ready and the Wait State, Minimum Mode Versus Maximum Mode.

Memory Interfacing: Memory Devices, Address Decoding, 8088/8086 Memory Interface, Dynamic RAM Controllers, Memory Testing.

**Basic I/O Interface Circuits:** Basic I/O Port Address Decoding, The 8255A Programmable Peripheral Interface, The 8279 Programmable keyboard/Disp1ay Interface, 8254 Programmable Interval Timer.

**Interrupts:** Basic Interrupt Processing, Hardware Interrupts, Expanding the Interrupt Structure, 8259A Programmable Interrupt Controller.

**Direct Memory Access:** Introduction to DMA, The 8257\_5 DMA Controller, and DMA Processed Printer Interface.

**Data Acquisition Systems:** Introduction, Analog to Digital Conversion Basics, Major Considerations for Data Acquisitions systems. Analog to Digital Converters, ADC Performance Parameters, ADC Code Sample & Hold Circuits, Analog Multiplexes, Analog Signal Isolation, Designing of a Data Acquisition system.

**Microprocessor Based Communications:** Introduction to Digital Communications, Serial Communications Interface Adapters, The825 IA Communications Interface Adapter, The

RS\_232C Interface Standard, Current Loops, Data Transmission Methods, Modems, IEEE 488, General Purpose Instrumentation Bus (GPIB), NEC 7210 GPIB Communication Interface.

Pre-requisite: Microcontroller & Microprocessor.

#### **Recommended Books:**

1. Real Time Interfacing: Engineering Aspects of Microprocessor Peripheral Systems by J.E. Cooling, Van Nostrand Reinhold Co, 1986.

2. Interfacing Techniques in Digital Design With Emphasis on Microprocessors by Ronald

L.Krutz, John Wiley, 1988.

3. Microprocessor and interfacing, Programming and Hardware by Douglas .V. Hall,

McGraw Hill Co, 1986.

4. The Intel Microprocessors: Architecture, Programming, and interfacing by B. Barry.

Macmillan Publishing Co, 1991

5. Microprocessor System Design by M. Spinks, Newnes, Oxford, 1992.

# Paper-XI

# **Research Project**

Project allocation will be made mutually between the staff and students. Different topics can be involved in the projects such as Hardware, software interfaces, Network protocols etc.