20ECTH01: ELECTRONIC MEASUREMENTS & INSTRUMENTATION

Credits - 3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **UniversityExam Marks: 70**

Course Objectives

1. To explain basic concepts and definitions in measurement.
2. To describe the bridge configurations and their applications.
3. To elaborate discussion about the importance of signal generators and analyzers in measurement.
4. To understand the concept of Transducer Technology and construct the equipment for measurement of physical parameters.

Course Outcomes

After successful completion of the course the student should be able to

CO1.Measure various electrical parameters with accuracy, precision, resolution.

CO2.Use AC and DC bridges for relevant parameter measurement.

CO3.Select appropriate passive or active transducers for measurement of physicalparameters.

CO4.Use Signal Generator, frequency counter, CRO and digital IC tester for appropriate measurement effectively.

CO5.Test and troubleshoot electronic circuits using various measuring instruments.

CO6.Maintain various types of test and measuring instruments.

UNIT I

General Electronic Instruments: Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error. DC Voltmeters- Multi-range, Range extension/Solid state and differential voltmeters, AC voltmeters- multi range, range extension, shunt. Thermocouple type RF ammeter, Ohmmeters series type, shunt type, Multi- meter for Voltage, Current and resistance measurements.

UNIT II

OSCILLOSCOPE : Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO, Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of frequency and phase measurement, standard specifications of CRO, probes for CRO- Active & Passive, attenuator type.

UNIT III

SIGNAL GENERATORS, WAVE& HORMOIC DISTROTIONANALYZER: Signal Generator-fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Random noise generator, Arbitrary waveform generator. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers.

UNIT IV

BRIDGES:DC Bridges-Wheat stone bridge, Kelvins bridge and Kelvins double bridge.

AC Bridges- Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance -SchearingBridge. Wien Bridge, Errors and precautions in using bridges. Q-meter.

UNIT V

Transducers: Active& passive transducers- Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors.

Text Books

1. HS. Kalsi –"Electronic Instrumentation", Mc Graw Hill Publications, 4th Edition, 2019.
2. Albert D. Helfrick& William D. Kooper-"Modern Electronic Instrumentation & Measurement Techniques", Prentice Hall India Learning Private Limited, 1992.

Reference Books

1. David A. Bell –"Electronic Instrumentation & Measurements ", PHI, 2nd Edition, 2003.
2. Robert A.Witte -"Electronic Test Instruments, Analog and Digital Measurements ", Pearson Education, 2ndEdITION., 2004.
3. K. Lal Kishore -"Electronic Measurements & Instrumentations ", Pearson Education – 2005.

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L											H		
CO2	H	L											H		
CO3		L	M	L		M	L						H		
CO4	H	L											H	L	
CO5		M	H	M									H	M	L
CO6			L	M		H								M	H

20ECTH02: RADAR SYSTEMS

Credits - 3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To derive the basic RADAR equation and its dependence on various parameters.
2. To study CW RADAR system and its applications along with FMCW RADAR system for altimeter applications.
3. To compare Pulse RADAR and MTI RADAR
4. To understand moving target indicator and to study its applications.
5. To study and understand the effect of noise on RADAR signal detection.

Course Outcomes

After successful completion of the course the student should be able to

CO1.Understand the basic concepts of Radar.

CO2. Analyze the CW Radar and FMCW Radar system for the measurement of speed and distance.

CO3. Apply the techniques to remove the clutter using MTI Radar and Pulse Doppler Radar.

CO4. Distinguish different navigation systems

CO5. Compare Navigation aids for direction finding and range of travel of aircrafts

UNIT I

Nature of Radar, simple form radar equation, radar blocks diagram and operation, Radar frequencies, applications of Radar.

Minimum detectable signal – Receiver noise, Probability Density function, signal-to-noise ratio, Radar cross section of target, cross-section fluctuations.

UNIT II

Radar Components: RF amplifier, TWT, CFA, Modulators, mixers – Conversion loss, Noise figure, Balanced mixer, Image recovery mixer, Duplexers – Branch type, Balanced type and solid-state duplexers, limiters, Displays – CRT displays, A, B,C, D – scopes, PPI and RHI.

UNIT III

Radar Systems: CW radar, frequency – modulated CW radar, multiple – Frequency CW radar, MTI radar – Delay line cancellers, Pulse repetition frequencies, Range-gated Doppler filters, tracking radar, Range and angle tracking, sequential lobbing and conical scanning.

UNIT IV

Navigational Systems: Radio direction finding and radio ranges, loop antenna, Goniometer, errors in direction finding, LF/MF four-course radio range, VHF –VOR,VOR receiving equipment.

UNIT V

Navigational Aids: Hyperbolic systems of navigation, DME, TACAN, Loran-A, Loran-C specifications, Decca navigation systems and Decca receivers, DME-operation, TACAN equipment.

Text Books

1. Merrill I. Skolnik ,"Introduction to Radar Systems", 2nd Ed.,Mc Graw Hill Education Special Indian Edition, 2007.
2. N.S. Nagaraju ,"Elements on electronic navigation " ,2nd edition 1996.

Reference Books

1. Mark A. Richards, James A. Scheer William A. Holm, Yesdee, " Principles of Modern Radar Basic Principles ",2013
2. G.M. Mikker ,"Modern Electronic Communication" ,6th edition, Prentice Hall 1999.
3. Kennedy &Davis ,"Electronic Communication Systems ", 4th edition, TMH 1993.

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M					L						H		L
CO2		H	M	L		L	L			M	L		L	H	M
CO3		H	M	L		L	L			M	L		L	H	M
CO4			H	M			L				L	L	H		M
CO5			H	M			L		L		L	L	H		M

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20ECTH04: OPTO ELECTRONICS

Instructions/week: 3Hrs **Sessional Marks: 30**
University Exam: 3hrs **Univ. Examinations Marks: 70**

UNIT –I

ELEMENTS OF LIGHT AND SOLID STATE PHYSICS: Wave nature of light, Polarization, Interference, Diffraction, Light Source, Review of Quantum Mechanical Concept, Review of Solid State Physics, Review of Semi conductor Physics and Semiconductor Junction Device.

UNIT –II

DISPLAY DEVICES AND LASERS: Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, LASER Emission, Adsorption, Radiation, Population Inversion, Optical Feedback, Threshold Condition, LASER Modes, Classes of LASERS, Mode Locking, LASER Applications.

UNIT –III

OPTICAL DETECTION DEVICES: Photo Detector, Thermal Detector, Photo Devices, Photo Conductors, Photo Diodes, Detector Performance.

UNIT -IV

OPTOELECTRONIC MODULATOR: Introduction, Analog and Digital Modulation, Electro-Optic Modulators, Magneto Optic Devices, Acoustic Devices, Optical, Switching and Logic Devices.

UNIT -V

OPTOELECTRONIC INTEGRATED CIRCUITS: Introduction,Hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated Transmitters and Receivers, Guided Wave Devices.

TEXT BOOKS:

1. Pallab Bhattacharya " SemiconductorOpto Electronic Devices", Prentice Hall of India Pvt., Ltd., New Delhi, 2006.
2. Jasprit Singh, "Opto Electronics-As Introduction to Materials and Devices", Mc Graw-Hill International Edition, 1998.

REFERENCE BOOKS:

1. S C Gupta, Opto Electronic Devices and Ssytems, Prentice Hal of India, 2005.
2. J. Wilson and J. Haukes, "Opto Electronics-An Introduction", Prentice Hall, 1995.

20ECTH05: MEMS: MICRO ELECTRO MECHANICAL SYSTEMS

Instructions/week: 3Hr **Sessional Marks: 30**
University Exam: 3hrs **Univ. Examinations Marks: 70**

UNIT-1

INTRODUCTION TO MICROSYSTEMS

Overview of microelectronics manufacture and Microsystems technology. Definition - MEMS materials. Laws of scaling. The multi disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS in various industries.

UNIT-2

MICRO SENSORS AND ACTUATORS

Working principle of Microsystems - micro actuation techniques - micro sensors – types – Microactuators – types – micropump – micromotors – micro – valves – microgrippers – microaccelerometers.

UNIT-3

FABRICATION PROCESS

Substrates - single crystal silicon wafer formation – Photolithography – Ion implantation – Diffusion – Oxidation – CVD - Physical vapor deposition - Deposition epitaxy - etching process.

UNIT-4

MICRO SYSTEM MANUFACTURING

Bulk Micro manufacturing - surface micro machining – LIGA – SLIGA - Micro system packaging materials - die level - device level - system level - packaging techniques – die preparation – surface bonding - wire bonding - sealing.

UNIT-5

MICROSYSTEMS DESIGN AND PACKAGING

Design considerations, Mechanical Design, Process design, Realization of MEMS components using intellisuite. Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS.

TEXT BOOKS

1. Mohamed Gad – el – Hak, “MEMS Handbook”, CRC Press, 2002.
2. Rai - Choudhury P. “MEMS and MOEMS Technology and Applications”, PHI Learning Private Limited, 2009.
3. Sabrie Solomon, “Sensors Handbook,” Mc Graw Hill, 1998.
4. Marc F Madou, “Fundamentals of Micro Fabrication”, CRC Press, 2nd Edition, 2002.

REFERENCE BOOKS:

1. Francis E.H. Tay and Choong .W.O, “Micro fluidics and Bio mems application”, IEEE Press New York, 1997.
2. Trimmer William S., Ed., “Micromechanics and MEMS”, IEEE Press New York, 1997.
3. Maluf, Nadim, “An introduction to Micro electro mechanical Systems Engineering”, AR Tech house, Boston 2000.
4. Julian W.Gardner, Vijay K.Varadan, Osama O. Awadel Karim, “Micro sensors MEMS and Smart Devices”, John Wiby& sons Ltd., 2001.

20ECTH07: INFORMATION THEORY& CODING

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives:

1. To define and apply the basic concepts of information theory (entropy, channel capacity etc.)
2. To learn the principles and applications of information theory in communication systems
3. To study various data compression methods and describe the most common such methods
4. To understand the theoretical framework upon which error-control codes are built

Course Outcomes:

Up on successful completion of this course a student will be able to:
CO1: Quantify the notion of information in a mathematically sound way.
CO2: Explain what the significance of this quantitative measure of information is in the communications systems.
CO3: Calculate entropy, joint entropy, relative entropy, conditional entropy, and channel capacity of a system.
CO4: Decide an efficient data compression scheme for a given information source.
CO5: Explain the impact of feedback and/or many senders or receivers on the communication systems

UNIT-1

Information theory: Concept of amount of information, information units Entropy: marginal, conditional, joint and relative entropies, relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels Discrete channels – Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Noise-Free Channel, Channel with independent I/O, Cascaded channels, repetition of symbols, Binary asymmetric channel, Shannon theorem.

UNIT-II

Source coding – Encoding techniques, Purpose of encoding, Instantaneous codes, Construction of instantaneous codes, Kraft's inequality, Coding efficiency and redundancy, Source coding theorem. Construction of basic source codes – Shannon Fano coding, Shannon Fano Elias coding, Huffman coding, Minimum variance Huffman coding, Adaptive Huffman coding, Arithmetic coding, Dictionary coding – LZ77, LZ78, LZW, ZIP coding Channel coding, Channel coding theorem for DMC.

UNIT-III

Codes for error detection and correction – Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes Cyclic codes – Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.

UNIT-IV

Convolutional codes – Encoding and State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes -Viterbi algorithm, Sequential decoding -Stack algorithm.

UNIT-V

Interleaving techniques – Block and convolutional interleaving, Coding and interleaving applied to CD digital audio system - CIRC encoding and decoding, interpolation and muting. ARQ – Types of ARQ, Performance of ARQ, Probability of error and throughput.

Textbooks:

1. T. M. Cover, J. A. Thomas, Elements of Information Theory, Wiley, 2nd ed, 2006.
2. R. Togneri, C.J.S deSilva, Fundamentals of Information Theory and Coding Design, Chapman & Hall/CRC, 1st edition, 2002.

References Textbooks:

1. R. J. McEliece, The Theory of Information and Coding, Cambridge Uinversity Press, 2nd edition, 2002.
2. R. Bose, Information Theory Coding and Cryptography, Tata McGraw Hill, 3rd edition, 2016.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO – PO - PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**H**	**M**	**M**										**M**		
CO 2		**L**	**M**	**H**										**M**	
CO 3	**H**	**H**								**L**		**L**	**H**		
CO 4			**L**		**H**					**M**				**L**	**H**
CO 5						**L**	**L**			**H**	**M**			**H**	**M**

20ECTH08: SATELLITE COMMUNICATION

Credits - 3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To learn Principles, architecture, advantages and disadvantages of satellite Communication.
2. To study various sub-systems of a satellite.
3. To familiarize various effects on satellite and its remedies.
4. To develop different parameters associated with satellite link budget.
5. To categorize types of antennas and its multiple access schemes.

Course Outcomes

After successful completion of the course the student should be able to

CO1. To understand the basic concepts of satellite Communication.

CO2. To analyze various satellite sub-systems and communication among them.

CO3. To create effects and remedies on satellite

CO4. To formulate equations and calculations for satellite link budget.

CO5**.** To analyze various types of modulations and multiple access schemes.

UNIT I

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication. Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

UNIT II

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellitesystem such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbitcontrol system (AOCS), Communication sub-system, Power supply, Station Keeping, Thermal control, TT&C subsystem, Transponders, Propulsion system, Antenna subsystem.

UNIT III

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remediesfor Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shiftphenomena and expression for Doppler shift.

UNIT IV

Space Link: Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio

calculations in clear air and rainy conditions, ERIP, Transmission losses, Link power budget equation system noise, E_b/E_o and C/N ratios, Up – link, Down link

UNIT V

Earth Station: Antenna types, High power amplifier, Low – amplifier, Up converter, Down converter. Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication

Multiple Access: Meaning of Multiple Access, Multiple access schemes based on time, frequency, FDMA, SPADE network, TDMA, Frame structure, CDMA, VSAT and MSATs.

Text Books

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

Reference Books

1. K. N. Rajarao, "Fundamentals of Satellite Communication", Prentice
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009

Course outcomes-Program outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L				L							H	M	
CO2		H	M	L			L		L	L	M	L	H		L
CO3			H	H			M				L	M		L	H
CO4		H				M	L		M	L	L	L		M	H
CO5		H	M	L			L		L	M	M	L	M	H	

20ECTH10 SYSTEM ON CHIP DESIGN

Credits - 3 **Sessional Marks: 30**
L: T: P: 3:0:0 **University Exam Marks: 70**

Course objectives

1. To understand the concepts of System on Chip Design methodology for Logic and Analog Cores.
2. To understand the concepts of System on Chip Design Validation.
3. To understand the concepts of SOC Testing.

Course Outcomes

After successful completion of the course the students should be able to
CO1. Understand about SoC Design Methodology.
CO2. Create the design of different embedded memories.
CO3. The SoC Design Validation and Testing Concepts can be understood**.**

UNIT–I

Introduction- System tradeoffs and evolution of ASIC Technology, System on chip concepts and methodology, SoC design issues, SoC challenges and components.

UNIT–II

Design Methodology for Logic Cores-SoC Design Flow, On-chip buses,Design process for hard cores, Soft and firm cores, Designing with hard cores, soft cores, Core and SoC design examples.

UNIT–III

Design Methodology for Memory and Analog Cores: Embedded memories, Simulation modes Specification of analog circuits, A to D converter, Phase-located loops, High I/O.

UNIT–IV

Design Validation: Core level validation, Test benches, SoC design validation, Co-simulation, hardware/Software co-verification.

Case Study: Validation and test of systems on chip.

UNIT-V

Soc Testing- SoC Test Issues, Testing of digital logic cores, Cores with boundary scan, Test methodology for design reuse– Testing of microprocessor cores – Built in self method –testing of embedded memories.

Case Study: Integrating BIST techniques for on-line SoC testing.

TEXTBOOKS:

1. RochitRajsunah, System on a chip: Design and Test, Artech House, 2007.
2. Prakash Raslinkar, Peter Paterson & Leena Singh, System-on-a-chip verification: Methodology and Techniques, Kluwer Academic Publishers, 2000.

REFERENCES:

1. M.Keating, D.Flynn, R.Aitken, A, Gibbons Shi ,Low Power Methodology Manual for System-on-Chip Design Series: Integrated Circuits and Systems,Springer,2007.
2. L.Balado, E.Lupon, Validation and test of systems on chip, IEEE conference on ASIC / SOC, 1999.
3. A.Manzone,P.Bernardi,M.Grosso,M.Rebaudengo,E.Sanchez,M.SReorda, Centro RicercheFiat,Integrating BIST techniques for on-line SoC testing.
4. IEEE Symposium on On-Line testing, 2005.

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Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO)

	PO 1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3	PSO4
CO1		H		L	M			L					H			L
CO2	L	M		M	H	L							L			H
CO3			M		M	M							M			M
CO4		M			M								L			M
CO5		L	H													L

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20ECTH11: LOW POWER VLSI DESIGN

Credits - 3 **Sessional Marks: 30**
L: T: P: 3:0:0 **University Exam Marks: 70**

Course Objectives

1. To know the sources of power consumption in CMOS circuits
2. To understand the various power reduction techniques and the power estimation methods.
3. To study the design concepts of low power circuits.
4. To study the concepts on different levels of power estimation.
5. To study the concepts on different levels of optimization techniques.

Course Outcomes

After successful completion of this course, the students should be able to
CO1.Know the basics and advanced techniques in low power design as reduction of power is much needed to enhance the performance of the system
CO2.Understand about the Circuit &Logic Techniques
CO3.Know the basics and advanced techniques in Low Power CMOS VLSI Design.
CO4.Understand about the Synthesis for Low Power Design and Test of Low Voltages
CO5.Understand about the Low Energy Course

UNIT I

Low power design, an over view Introduction to low- voltage low power design, limitations, Silicon-on-Insulator.
MOS/Bi-CMOS Processes: Bi-CMOS processes, Integration and Isolation considerations, Integrated Analog/Digital CMOS Process.

UNIT II

Low-voltage/low power CMOS/ BICMOS Processes Deep submicron processes, SOI CMOS, lateral BJT on SOI, future trends and directions of CMOS/Bi-CMOS processes.

UNIT III

CMOS and Bi-CMOS logic gates Conventional CMOS and Bi-CMOS logic gates, Performance Evaluation.
Low power latches and flip flops Evolution of Latches and Flip flops-quality measures for latches and Flip flops, Design perspective.

UNIT IV

Architecture and system Power and Performance Management, Microprocessor Sleep Modes, Perfomance Management, Adaptive Filtering, Switching Activity Reduction, Guarded Evaluation, Bus Multiplexing, Glitch Reduction by Pipelining

UNIT V

Special techniques Power Reduction in Clock Networks, CMOS Floating Node,
Low Power Bus, Delay Balancing, Low Power Techniques for SRAM.

Text Books

1.CMOS/Bi-CMOS ULSI low voltage, low power by Yeo Rofail/ Gohl (3 Authors)-Pearson Education Asia 1st Indian reprint, 2002.
2.Gary K. Yeap,"Practical Low Power Digital VLSI Design", KAP, 2002.

References

1.P. Rashinkar, Paterson and L. Singh, "Low Power Design Methodologies", Kluwer Academic, 2002
2.Kaushik Roy, Sharat Prasad, "Low power CMOS VLSI circuit design", John Wiley sonsInc.,2000.
3.J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley, 1999.
4.A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer,1995.
5.Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M					H	M	
CO2		H	L	L			M	H	
CO3		M	H	L			H	M	L
CO4	M	H		L			M	H	L
CO5		H		M			L	H	