

### 7<sup>th</sup> /8<sup>th</sup> Semester

Course Code	Course Title	Course Component	Internal Marks	External Marks	Total Marks	Credits
<b>TREC-14701</b>	Industrial Training-II (Six months	Industrial Training - II	450	350	800	13
<b>TREC-14702</b>	Industrial Training)	Industry Oriented Training	200	-	200	2
<b>Total</b>			650	350	<b>1000</b>	<b>15</b>

### 7<sup>th</sup>/8<sup>th</sup> Semester

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
<b>EC-14701</b>	VLSI Design	3	1	-	40	60	100	4
<b>EC-14702</b>	Optical Communication	3	1	-	40	60	100	4
<b>EC-14703</b>	Engineering Management	3	1	-	40	60	100	4
<b>DEEC-147XX</b>	Department Elective-III	3	1	-	40	60	100	4
<b>DEEC-147YY</b>	Department Elective-IV	3	1	-	40	60	100	4
<b>EC-14715</b>	Lab Optical Communication	-	-	2	30	20	50	1
<b>EC-14716</b>	Lab VLSI Design	-	-	2	30	20	50	1
<b>PREC-14701</b>	Major Project	-	-	3	120	80	200	3
<b>GF-14701</b>	General Fitness	-	-	1	100	NA	100	1
<b>TOTAL</b>		<b>15</b>	<b>5</b>	<b>8</b>	<b>480</b>	<b>420</b>	<b>900</b>	<b>26</b>

#### Departmental Elective –III (Common Code XX)

DEEC-14704	CMOS based Design
DEEC-14705	Biomedical Electronics
DEEC-14706	Satellite Communication
DEEC-14707	Speech & Image Processing
DEEC-14708	Human Resource Management
DEEC-14709	Computer Organization and Architecture

#### Departmental Elective – IV (Common Code YY)

DEEC-14710	CAD for VLSI Design
DEEC-14711	Wireless Sensor Networks
DEEC-14712	Operation Research
DEEC-14713	Mobile Computing
DEEC-14714	Numerical Methods in Engineering

**COURSE NAME: VLSI DESIGN**

**COURSE CODE: EC-14701**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 30%-40%**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

### Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Apply the knowledge of basic MOS structure in CMOS technology.	1(H)	1(L), 3(L)
CO2	Comprehend the electrical characteristics of MOS circuits using mathematical equations.	1(H)	1(L)
CO3	Assess the effect of scaling on the performance of MOS circuits.	1(H), 2(H), 4(M)	1(M), 3(M)
CO4	Make use of hardware description language VHDL to represent digital circuit.	5(H)	3(L)
CO5	Design combinational and sequential circuits for given specifications using VHDL features.	1(H), 3(H), 5(H)	3(M)
CO6	Work in a team to construct code and design component for given application and engage in life-long learning.	1(H), 3(H), 5(H), 9(M), 12(H)	3(M)

### Syllabus:

**[Total Contact Hours: 42+14(T)=56]**

#### **Unit 1. Review of MOS Devices[4+2=6]**

MOS Structure, NMOS, PMOS and CMOS fabrication, Enhancement & Depletion Transistor.

#### **Unit 2. Basic Electrical Properties and Circuit Concepts [8+3=11]**

MOS device design equations: drain current-voltage, threshold voltage, transconductance. NMOS Inverter and Transfer characteristics, pull up and pull down ratios of NMOS, alternative forms of pull up, CMOS Inverter and transfer characteristics, Latch-up in CMOS circuits.

### **Unit 3. Scaling of MOS Circuits[4+2=6]**

Scaling Models, Scaling factors for device parameters, Limitations of Scaling.

### **Unit 4. Introduction to VHDL [8+3=11]**

Introduction to VLSI design cycle, Computer-aided design tools for digital systems, Hardware description language: VHDL, features, Data objects, Classes and data types, Operators, Sub-programs, Overloading.

### **Unit 5. Architecture Modeling Styles[10+2=12]**

Behavioral, structural, data flow style of modeling: Assignment statements, Sequential Statements and Process, Conditional Statements, Case Statements, Loops, Resolution Functions, Packages & Libraries, Concurrent Statements.

### **Unit 6. Applications of VHDL[8+2=10]**

Combinational Circuit Design such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc., Sequential Circuit Design such as Shift registers, Counters, Flip-flops etc.

#### **Text Books:**

1. J. Bhasker, "A VHDL Primer", Prentice Hall PTR, 1999.
2. D. A. Pucknell and K. Eshraghian, "Basic VLSI Design", Prentice Hall India, 3<sup>rd</sup> Edition, 2003.
3. Neil H. E. Weste and K. Eshraghian, "Principle of CMOS VLSI Design: A Systems Perspective" Addison Wesley, 2000.
4. D. L. Perry, "VHDL: Programming by Example", Tata McGraw-Hill, 2002.

#### **Reference books and other resources:**

1. S. Brown and Z. Vranesic, "Fundamentals of Digital Logic with VHDL Design" McGraw-Hill Education, 2008.
2. S.- M. Kang, Y. Leblebici, "CMOS digital integrated circuits: Analysis & design", Tata McGraw-Hill, 3<sup>rd</sup> Edition, 2003.

#### **E books and online learning materials:**

1. [https://www.tutorialspoint.com/vlsi\\_design/vlsi\\_design\\_tutorial.pdf](https://www.tutorialspoint.com/vlsi_design/vlsi_design_tutorial.pdf)
2. <https://web.ewu.edu/groups/technology/Claudio/ee430/Lectures/L1-print.pdf>

#### **MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/117106093/1>
2. <http://nptel.ac.in/courses/117106093/3>

**COURSE NAME: OPTICAL COMMUNICATION**

**COURSE CODE: EC-14702**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 20%-30%**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

**Course Outcomes**

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Apply the knowledge of engineering fundamentals for the concept of optical fiber communication.	1(H)	1(H)
C02	Demonstrate the basic concept of degradation, fabrication and measurement techniques. <del>employed in fibers</del>	1(M)	1(M)
CO3	Design system components of optical sources and detectors and derive the expression for their efficiency.	3(H)	1(M), 2(H)
CO4	Select electronic components to describe the concept of Optical link design.	5(H)	3(M)
CO5	Analyze the performance of different optical amplifiers and integrated optical devices.	2(H)	1(H)
CO6	Use research-based knowledge to describe the concepts of nonlinear optical effects in optical communication system.	4(H)	1(M)

**Syllabus:**

**[Total Contact Hours: 42+14(T)=56]**

**Unit 1. Introduction**

**[7+2=9]**

Elements of an optical fiber transmission link, introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

**Unit 2. Optical Fibers[9+4=13]**

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation in optical waveguides due to dispersion and attenuation, pulse broadening in graded-index waveguides, mode coupling, fiber fabrication: vapor-phase axial deposition, plasma-activated chemical deposition and double-crucible method. Measurement techniques: optical spectrum analyzers, optical time domain reflectometer (OTDR).

### **Unit 3. Optical Sources and Detectors**

[8+3=11]

Optical sources - LEDs and Lasers, Photo-detectors - pin-detectors, Avalanche photodiode, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

### **Unit 4. Optical Amplification and Integrated Optics[8+2=10]**

Optical amplifiers – semiconductor optical amplifier, EDFA, Raman amplifier, Integrated optical devices: directional couplers, electro-optic switches, modulator, polarization transformer, frequency translators.

### **Unit 5. Nonlinear Optical Effects**

[10+2=12]

Nonlinear effects in fiber optic links. Concept of stimulated light scattering, self-phase modulation, four wave mixing, group velocity dispersion and soliton based communication.

#### **Text Books:**

1. G. Keiser, “Optical Fiber communications”, McGraw Hill Education, 3<sup>rd</sup> Edition, 2000.
2. J. M. Senior, “Optical Fiber Communications, Principles and Practices”, Pearson Education, 3<sup>rd</sup> Edition, 2010.

#### **Reference books and other resources:**

1. J.E. Midwinter, “Optical Fibers for Transmission”, John Wiley, 1979.
2. J. Gowar, “Optical Communication Systems”, Prentice Hall India, 1987.
3. G. Agrawal, “Nonlinear Fibre Optics”, Academic Press, 2<sup>nd</sup> Edition 1994.
4. G. Agrawal, “Fiber Optic Communication Systems”, John Wiley and Sons, New York, 1992

#### **Research Papers**

1. “A comprehensive study of linear and non-linear optical properties of novel charge transfer molecular systems” B.A Sriyanka Mendis, K.M Nalin de Silva, Journal of Molecular Structure: THEOCHEM, Volume 678, Issues 1–3, June 2004, Pages 31-38.
2. “Non-linear optical materials and applications”, Y. Fainman, J. Ma, S.H. Lee, Research article Materials Science Reports, Volume 9, Issues 2–3, January 1993, Pages 53-139.

#### **E books and online learning materials:**

1. <https://eceagmr.files.wordpress.com/2014/09/optical-fiber-communications-principles-and-pr.pdf>
2. <https://www.utdallas.edu/~torlak/courses/ee4367/lectures/FIBEROPTICS.pdf>

#### **MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/117101002/34>
2. <http://nptel.ac.in/courses/117101002/38>

**COURSE NAME: ENGINEERING MANAGEMENT**

**COURSE CODE: EC-14703**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 10%-20%**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

**Course Outcomes**

On successful completion of this course, the students should be able to:

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
C01	Developability to analyze and solve problems methodically as well as manage individual and team projects with appropriate consideration of engineering and financial aspects.	11(H)	
C02	Apply knowledge of economics for the analysis of engineering and management issues.	11(H)	
CO3	Develop an understanding of professional, ethical and social responsibilities as professional Engineer and manager.	8(H)	
CO4	Analyze the relationship between performance management and organizational effectiveness.	11(M)	
CO5	Explain the importance of risk management and quality management	11(H)	
CO6	Function effectively in groups and teams as a member / leader.	9(H)	

**Syllabus:**

**[Total Contact Hours: 42+14(T)=56]**

**Unit 1. Project Management**

**[5+1=6]**

Project and Project Management, Project life cycle, Organizational structures (functional, matrix and projectized), Importance of organizational structures.

**Unit 2. Engineering Economics**

**[7+2=9]**

Introduction to engineering economics- Importance, Time value of money, Interest and Interest Rate, Cost analysis- Breakeven analysis, Two and three alternatives, Breakeven charts, effects of changes in fixed and variable cost, Economic life of a project, Economic analysis- Decision

making in selection of alternative by Rate of Return method and Uniform Annual Cost method.

**Unit 3. Leadership and Management** **[6+2=8]**

Introduction to Leadership and Leadership Effectiveness, Qualities of a Leader, Effects of a Leader on Management performance, Team and Team Development, Evaluation of performance of a team, Relationship between a leader and its team.

**Unit 4. Ethical Management** **[4+2=6]**

Ethical responsibility towards organization, Effect of ethics on management, Corporate social Responsibility (CSR).

**Unit 5. Human resource management** **[5+1=6]**

Role of Human Resources, Strategic Planning in HRM, Recruitment Process, Training and Development, Employee Assessment.

**Unit 6. Motivation of employees** **[6+2=8]**

Need, Effects on management, Motivational Techniques, Motivational Theories (Maslow's hierarchy of needs, Herzberg's two-factor theory, Vroom's expectancy theory and Locke's goal theory).

**Unit 7. Risk and Risk Management** **[4+2=6]**

Types of risks, Effects of risk on management, Risk management strategies, Risk reduction strategies.

**Unit 8. Quality Management** **[5+2=7]**

Scope, Benefits of standardization, Quality Planning, Quality Assurance, Configuration Management.

**Text Books:**

1. K.R. Singhal and R. Singhal, "Engineering Economics and Industrial Management", Kataria and Sons, 1<sup>st</sup> Edition, 2014.
2. G. Dessler, "Human Resource Management" Pearson Publications, 13<sup>th</sup> edition, 2011
3. K. Nagarajan, "Project Management", New Age International Publishers, New Delhi, 3<sup>rd</sup> edition, 2007.

**Reference books and other resources:**

1. B. Patnayak, "Human Resource Management", PHI, 3<sup>rd</sup> Edition, 2010.
2. K. Schwalbe, "An Introduction to Project Management", Paperback, 5<sup>th</sup> Edition, 2015.
3. G.J. Thuesen, W.J. Fabrycky, "Engineering Economy" Prentice Hall, 2001.
4. C. E. Bullinger, "Engineering Economic Analysis" Tata McGraw Hill, 1950.
5. "Engineering Economic Analysis" Available (online)  
[<http://www.nptel.ac.in/courses/112107209>]

**E books and online learning materials:**

1. <https://www.robertfreund.de/blog/wp-content/uploads/2014/05/anisic-freund-susic-2013.pdf>
2. [https://www.researchgate.net/profile/Osama\\_Suleiman\\_Khayal/publication/305709980\\_project\\_management/links/591c18dda6fdcc701fd2bcbe/project-management.pdf](https://www.researchgate.net/profile/Osama_Suleiman_Khayal/publication/305709980_project_management/links/591c18dda6fdcc701fd2bcbe/project-management.pdf)

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/110102058/4>
2. <http://nptel.ac.in/courses/110102058/22>



**COURSE NAME: CMOS BASED DESIGN**

**COURSE CODE: DEEC-14704**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 20%-30%**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

### **Course Outcomes**

On successful completion of this course, the students should be able to:

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
CO1	Comprehend the basic knowledge of MOS structures, MOS models, MOS scaling and its effects.	1(H)	1(M)
CO2	Demonstrate the process steps and issues related to CMOS fabrication and manufacturing process.	4(M)	1(M)
CO3	Apply the concept of stick diagrams and layout design rules for formation of CMOS based circuits.	5(M)	2(H)
CO4	Analyze MOS circuit characteristics, performance parameters, various interconnect parasitic elements and scaling factors.	2(H)	2(M)
CO5	Design solutions for different logic circuits using pass transistor logic, static and dynamic CMOS circuits.	5(H)	3(H)
CO6	Implement efficient techniques at circuit level for improving power and speed of combinational and sequential circuits.	2(H)	3(M)

### **Syllabus:**

**[Total Contact Hours:39+13(T)=52]**

#### **Unit 1. Introduction to MOS device**

**[9+3=12]**

Introduction to IC Technology, Basic MOS Transistor (enhancement and depletion mode), NMOS process, CMOS process (P-well, N-well and twin-tub). MOS models, MOS structure capacitance, Non ideal I-V effects, Mobility degradation and velocity saturation, channel length modulation, threshold voltage effects, Leakage, temperature and geometry dependence, Resistive operation, saturation region, body effect, DC transfer characteristics, Tristate inverters, Hotcarrier effect, drain current v/s voltage charts, sub threshold conduction.

**Unit 2. CMOS Processing****[9+2=11]**

CMOS technologies, wafer formation photolithography channel formation, isolation, gate oxide, gate source, drain formation, contacts and metallization, layout design rules, design rule checking. CMOS process enhancement, fabrication and manufacturing issues, CMOS layout and stick diagrams.

**Unit 3. Circuit Characterization & Performance Estimation****[9+3=12]**

Delay estimation , delay models, inverter design using delay constraints, sources of power dissipation, estimation of interconnect parasitic, calculation of interconnect delay, reliability, variability, transistor sizing, Scaling models, scaling factor for device parameters, Advantages and Limitations of scaling.

**Unit 4. Design of Combinational & Sequential Circuits****[12+5=17]**

Static CMOS design, complementary CMOS, static properties, complementary CMOS design, Power consumption in CMOS logic gates, dynamic or glitching transitions, Design to reduce switching activity, Radioed logic, DC VSL, pass transistor logic, Differential pass transistor logic, sizing of level restorer, sizing in pass transistor, Dynamic CMOS design, Domino logic, optimization of Domino logic, NPCMOS, Implement efficient techniques at circuit level for improving power and speed of combinational and sequential circuits, Designing logic for reduced supply voltages, Pitfalls and Fallacies, sequencing static circuits and circuit design of latches and flip flops.

**Text Books:**

1. Weste& Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3rd ed, Addison Wesley, 2005.
2. Nail H.E. Weste, David Harris, Ayan Banerjee, —CMOS VLSI DESIGN|| , Pearson Education.

**Reference books and other resources:**

1. Jan M Rabaey, Digital Integrated Circuits, 2nd Edition, Pearson Education, 2003.
2. Patterson& Hennessy, Computer Organization & Design, 2nd ed, Morgan Kaufmann, 1998.
3. Sung-Mo Kang, CMOS Digital Integrated Circuits, 3rd Edition, McGraw-Hill, 2003.
4. Kang and Leblebici —CMOS Digital integrated circuits||, TMH 2003.
5. Wayne Wolf, —Modern VLSI Design ", 2nd Edition, Prentice Hall, 1998.

**E books and online learning materials:**

1. [https://www.ucursos.cl/usuario/9553d43f5ccbf1cca06cc02562b4005e/mi\\_blog/r/CMOS\\_Circuit\\_Design\\_\\_Layout\\_\\_and\\_Simulation\\_\\_3rd\\_Edition.pdf](https://www.ucursos.cl/usuario/9553d43f5ccbf1cca06cc02562b4005e/mi_blog/r/CMOS_Circuit_Design__Layout__and_Simulation__3rd_Edition.pdf)
2. [http://www.rnbs.hiroshima-u.ac.jp/RCNS/lecture/pdf/HJM\\_H20/OHP\\_CMOS\\_5\(H20-5-9\).pdf](http://www.rnbs.hiroshima-u.ac.jp/RCNS/lecture/pdf/HJM_H20/OHP_CMOS_5(H20-5-9).pdf)

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/117101105/1>

2. <http://nptel.ac.in/courses/114101105/3>

**COURSE NAME: BIOMEDICAL ELECTRONICS****COURSE CODE: DEEC-14705****Internal Marks: 40****L T P****External Marks: 60****3 1 -****Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

**Course Outcomes**

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
C01	Apply the knowledge of signals in determining the output.	1(H)	1(M)
C02	Demonstrate the methods for recording and measuring various bio potentials	1(M)	1(M)
CO3	Comprehend the basic concept of imaging system and apply in biomedical domain.	1(M)	1(L)
CO4	Select and utilize electronic equipments for solving electronics circuit problems.	5(H)	1(M)
CO5	Analyze performance of different types of therapeutic equipments.	2(H)	1(H)
CO6	Design an application by working in a team comprising of medical experts.	3(M), 9(H)	1(M)

**Syllabus:****[Total Contact Hours: 39+13= 52]****Unit 1. Measuring, Recording and Monitoring Instruments****[8+3=11]**

MEMS, Bioelectric signals, electrodes, biosensors, ECG, EEG, Oximeters, Biotelemetry, Clinical data Interchange Standards, Cyber Medicine, Spirometry, Pulmonary Function Analyzers, Blood cell counters.

**Unit 2. Modern Imaging Systems[11+4=15]**

Basics of Diagnostic Radiology, X-ray machine, Visualization of X-rays, Physical parameters for X-ray Detectors, Principle of NMR Imaging system, Image reconstruction techniques, Basic NMR components, Biological effect of NMR imaging, Advantages of NMR imaging system.

**Unit 3. Ultrasonic Systems[9+3=12]**

Basics of diagnostic radiology, Diagnostic Ultrasound, Physics of Ultrasonic waves, Medical ultrasound, Three-dimensional ultrasound imaging systems, Portable ultrasound systems

**Unit 4. Therapeutic Equipment[11+3=14]**

Need for Cardiac pacemakers, Implantable pacemakers, DC Cardiac defibrillators, Surgical Diathermy, Physiotherapy equipment, Electrotherapy equipment, Capnography, Radiotherapy equipment, Laser applications in Biomedical field.

**Text Book:**

1. R. S. Khandpur, “Magnetic Resonance Imaging System”, in Handbook of Biomedical Instrumentation, Third Edition, New Delhi, India: McGraw Hill Education, 2014.

**Reference books and other resources:**

1. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2004.
2. Leislle Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.

**E books and online learning materials:**

1. [http://www.home-machine-shop.com/Intro\\_Medical\\_Electronics\\_Applications.pdf](http://www.home-machine-shop.com/Intro_Medical_Electronics_Applications.pdf)
2. [http://www.robots.ox.ac.uk/~gari/teaching/b18/lecture\\_slides/B18\\_LectureA.pdf](http://www.robots.ox.ac.uk/~gari/teaching/b18/lecture_slides/B18_LectureA.pdf)

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/114108037/11>
2. <http://nptel.ac.in/courses/114108037/15>

**COURSE NAME: SATELLITE COMMUNICATION**

**COURSE CODE: DEEC-14706**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 20%-30%**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

### **Course Outcomes**

On successful completion of this course, the students should be able to:

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
C01	Comprehend the basic concept of Satellite Systems and apply in different domains.	1(H)	1(L)
C02	Develop an understanding of Kepler's laws, satellite orbital elements and the Space segment.	2(M)	1(M)
CO3	Comprehend the basic concept of propagation impairments. in Satellite Systems	1(M)	1(L)
CO4	Design and analyze Satellite System Link budget.	5(H)	1(H)
CO5	Analyze performance of different types of Multiple Access systems	2(H)	1(M)
CO6	Explain the importance of various Satellite applications & Specialized services.	1(H)	1(M)

### **Syllabus:**

**[Total Contact Hours: 39+13=52]**

#### **Unit-1. Introduction to Satellite Communication**

**[5+1=6]**

Historical evolution of Satellite Communication, Frequency allocation of Satellite Services, INTELSAT, Applications, Future trends in Satellite Communication.

**Unit-2. Orbital Mechanism and Space Segment****[8+4=12]**

Kepler's laws of planetary motion, terms used for earth orbiting satellites, orbital elements, Geostationary orbit and non-Geostationary orbits, Angle of azimuth & Angle of elevation, Satellite Attitude Control, Satellite Station Keeping ; Telemetry, Tracking, Command & Monitoring (TTC&M); Transponder.

**Unit-3.Propagation impairments****[5+3=8]**

Propagation impairments: Atmospheric loss, Ionospheric effects, Rain attenuation, Depolarization, Tropospheric scintillation, Cloud attenuation and other impairments.

**Unit-4. Satellite Link design****[8+2=10]**

Basic transmission theory, System Noise Temperature, C/N and G/T ratios, Satellite Downlink design- link budget, Uplink design, System design examples.

**Unit-5. Satellite Access****[7+2=9]**

Multiple access schemes: FDMA : Fixed assigned FDMA, Demand Assigned FDMA-SPADE System, TDMA : Frame Structure, Reference Burst structure, Traffic burst structure, Frame acquisition & synchronization, Fixed assigned TDMA, Demand assigned TDMA, Introduction to CDMA.

**Unit-6. Satellite Services****[6+1=7]**

INSAT, VSAT, Mobile satellite services-GPS, Satellite Navigation system, Direct Broadcast satellite(DBS)-television , Digital Audio Broadcast (DAB).

**Text Books:**

1. T. Pratt, C. Bostian& J. Allnut, 'Satellite Communications', 2<sup>nd</sup> Ed., Wiley India, New Delhi, 2008
2. D. Roddy, 'Satellite Communications', 4<sup>th</sup> Ed., Tata Mc-Graw-Hill, New Delhi, 2009.

**Reference books:**

1. A. K. Maini and V. Agrawal, 'Satellite Communications', 1<sup>st</sup> Ed., Wiley India Pvt. Ltd., New Delhi, 2010
2. Tri T.Ha, 'Digital Satellite Communications', 2<sup>nd</sup> Ed., Tata McGraw-Hill, New Delhi, 2009
3. Dr. D. C. Agarwal, ' Satellite Communications', 6<sup>th</sup> Ed., Khanna Publishers,2008

**E books and online learning materials:**

1. [http://archive.mu.ac.in/myweb\\_test/Satelight%20Comm..pdf](http://archive.mu.ac.in/myweb_test/Satelight%20Comm..pdf)
2. [https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-851-satellite-engineering-fall-2003/lecture-notes/121satelitecomm2\\_done.pdf](https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-851-satellite-engineering-fall-2003/lecture-notes/121satelitecomm2_done.pdf)

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/106105082/4>

2. <http://nptel.ac.in/courses/106105082/15>

**COURSE NAME: SPEECH & IMAGE PROCESSING**

**COURSE CODE: DEEC-14707**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 20%-30%**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

### Course Outcomes

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Apply the basics of digital image processing	1(H), 3(H)	1(L)
CO2	Analyze image transforms and enhancement techniques in time and frequency domains	1(H),2(H)	1(H)
CO3	Analyze and interpret the color and multispectral aspects of three dimensional images	1(H),4(H)	1(H),2(L)
CO4	Use artificial intelligence techniques for processing speech	4(H)	1(H),2(L)
CO5	Develop solutions for speech processing systems with concern to societal needs	3(H)	1(H)
CO6	Interpret and synthesize speech signals to develop speech processing systems	4(H)	1(H)

**Syllabus:[ Total Contact Hours: 40+13(T)=53]**

**Unit 1. Digital Image Fundamentals [6+2=8]**

Origin of digital image processing, fundamental steps & components of digital image processing, Elements of visual perception, light electromagnetic spectrum, image sensing & acquisition, image sampling & quantization, Connectivity and Relations between Pixels.

**Unit 2. Image transforms and enhancement [9+4=13]**

Image Transforms: 2D Orthogonal and Unitary Transforms: Properties and Examples, 2D DFT, FFT, DCT, Hadamard Transform, Haar Transform, Slant Transform, KL Transform: Properties and Examples.



Image Enhancement: Histogram modeling, equalization and modification, Image smoothing, Image crispening.

**Unit 3. Color and multispectral image processing [8+3=11]**

Color Image Processing Fundamentals, RGB Models, HSI Models, Relationship Between Different Models. Multispectral Image Analysis, Color Image Processing Three Dimensional Image Processing, Computerized Axial Tomography, Stereometry, Stereoscopic Image Display, Shaded Surface Display.

**Unit 4. Representation of speech and speech production [9+2=11]**

Models of Speech production: Human speech production mechanism, acoustic theory of speech production, digital models for speech production, Perception of Loudness, Critical bands, Pitch perception, Auditory masking.

**Unit 5. Automatic speech recognition (ASR) [8+2=10]**

The Decision processes in ASR, Representative recognition performance, Principle Component Analysis, Singular Value Decomposition, Usage of Artificial Intelligence and Linear algebra in Speech processing.

**Text Books:**

1. Rafael C. Gonzalez and Richard E. Woods: Digital Image Processing, Addison-Wesley, 1992
2. T.F. Quatieri: Discrete-time Speech Signal Processing, Prentice-Hall, PTR, 2001.

**Reference books:**

1. Anil K. Jain: Fundamentals of Digital Image Processing, Prentice Hall, 1989.
2. William K. Pratt: Digital Image Processing, 4th Edition, John Wiley & Sons Inc., 2007.
3. Kenneth R. Castleman: Digital Image Processing, Prentice Hall, 1996.
4. Lawrence R. Rabiner and Ronald. W. Schafer: Introduction to Digital speech processing, now publishers USA, 2007.

**E books and online learning materials:**

1. [https://www-i6.informatik.rwthachen.de/web/Teaching/Lectures/WS06\\_07/Signal/skript.pdf](https://www-i6.informatik.rwthachen.de/web/Teaching/Lectures/WS06_07/Signal/skript.pdf)
2. <http://cpsc.yale.edu/sites/default/files/files/tr474.pdf>

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/114105145/1>
2. <http://nptel.ac.in/courses/114105079/14>

**COURSE NAME: HUMAN RESOURCE MANAGEMENT**

**COURSE CODE: DEEC-14708**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

**Course outcomes:**

On completion of syllabus students will be able to:

CO	Definition	POs	PSOs
CO1	Interpret planned keys of human resources to function within organization.	7(H)	1(L)
CO2	Discover current issue, trends, processes and practices in HRM.	8(M)	1(L)
CO3	Develop &Extend employability skills to work as an individual and as a group for all workspaces.	9(H)	1(L)
CO4	Combine employee's performance management and organizational effectiveness.	11(H)	1(L)
CO5	Apply contextual knowledge to assess social and legal issues in an organization.	6(H)	1(L)
CO6	Utilize oral and written skills to communicate effectively on engineering activities in organization.	10(H)	1(L)

**Syllabus: [ Total Contact Hours: 40+13=53]**

**Unit 1. Introduction to Human Resource [6+2=8]**

Definition, Role and Functions of Human Resource Management, Concept and Significance of HR, Role of HR managers, HR functions and Global Environment.

**Unit 2. Human Resources Planning [9+3=12]**

Need and Process for Human Resource Planning, Methods of Recruitment, The Process of Human Resource Planning, Difficulties in human resource planning, Recruitment and selection processes, Sources of Recruitment, Restructuring strategies, Placement and Induction, Retention of Employees, , Employment Exchanges.

### **Unit 3. Training and Development [9+3=12]**

Principles of Training, Employee Development, Need for skill up gradation, Assessment of training needs, Retraining and Redeployment methods and techniques of training employees and executives, performance and potential appraisal systems, 360 degree appraisal and feedback, Career Development & Planning.

### **Unit 4. Job analysis, Design and Satisfaction [9+3=12]**

Job Analysis & Job Description, Job Specification, Job Specification versus Job Description, Job satisfaction, Motivation, Factors affecting motivation, Theories of Motivation, Quality of work life.

### **Unit 5. Industrial Relations [7+2=9]**

Factors influencing industrial relations, State Interventions and Legal Framework, Role of Trade unions, Structure of Trade Unions, Collective Bargaining, Worker's participation in management.

#### **Text Books:**

1. Gary Dessler, Human Resource Management (8th ed.), Pearson Education, Delhi
2. A Minappa and M. S. Saiyada - Personnel Management (Tata Mc. Graw-Hill)

#### **Reference Books:**

1. T.N.Chhabra- Human Resource Management (DhanpatRai& Co.).
2. Biswajeet Patanayak, Human Resource Management, PHI, New Delhi

#### **E books and online learning materials:**

1. [http://archive.mu.ac.in/myweb\\_test/M.Com.%20Study%20Material/Human%20Res.%20Management%20-%20M.%20Com%20-%20I.pdf](http://archive.mu.ac.in/myweb_test/M.Com.%20Study%20Material/Human%20Res.%20Management%20-%20M.%20Com%20-%20I.pdf)
2. <https://openaccess.leidenuniv.nl/bitstream/handle/1887/22381/ASC-075287668-3030-01.pdf>

#### **MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/122105020/1>
2. <http://nptel.ac.in/courses/122105020/7>

**COURSE NAME: COMPUTER ORGANIZATION AND ARCHITECTURE****COURSE CODE: DEEC-14709****Internal Marks: 40****L T P****External Marks: 60****3 1 -****Numerical & Design Problems Content: 20%-30%****Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

**Course Outcomes**

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Able to describe the structure and functioning of a digital computer, operating system and digital components.	1(H),2(H)	2(H)
CO2	Able to explain the generic principles that underlie the building of digital computer, digital logic and processor programming.	2(H),4(H),5(M)	2(H),3(H)
CO3	Comprehend the architecture and organization of computers	1(M),5(M)	3(H)
CO4	Describe the memory organizations in a computer system	1(M),5(L)	2(H),3(M)
CO5	Explain the concept of sequencing and memory management in an operating system.	1(M),5(L)	2(M)
CO6	Discuss the hardware and software performance issues in a multi-core organization	1(M),5(L),6(M),11(M)	3(M)

**Syllabus:****[Total Contact Hours:38+13(T)=51]****Unit 1. Introduction****[10+3=13]**

Organization and Architecture, Structure and Function, Brief history of Computers, Designing for performance, Performance metrics: MIPS, MFLOPS, Computer Components and Functions, Interconnection Structures, Bus Interconnection, Point-to-Point Interconnect, PCI Express, Flynn's classification of Computers (SISD, MISD, MIMD), Error Detection and Correction.

**Unit 2. Internal and Cache Memory****[9+3=12]**

Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design,

Pentium 4 Cache Organization, Semiconductor Main Memory, Advanced Drum Organization

**Unit 3. Basic non Pipeline CPU Architecture and Operating System [10+4=14]**

CPU Architecture, types(accumulator, register, stack, memory/register) detailed data path of a typical register based CPU, Fetch-Decode-Execute cycle (typically 3-5 stage), microinstruction sequencing, implementation of control unit, Enhancing performance with pipelining, Operating system overview, Scheduling, Memory Management, Pentium Memory Management, RISC v/s CISC.

**Unit 4. Parallel Processing and Multi-Core computer [9+3=12]**

Multiple Processor Organizations, Symmetric Multiprocessors, Cache Coherence and the MESI protocol, Multithreading and Chip Multiprocessors, Clusters, Non-Uniform Memory Access, Vector Computation, Multi-Core Computers, Hardware and Software Performance Issues, Multi-Core Organization, Intelx86 Multi-Core Organization

**Text Books:**

1. William Stallings, Computer Organization and Architecture, 9/E Pearson, Delhi.

**Reference Books:**

1. Computer Architecture and Organization, 3<sup>rd</sup> Edition, John P. Hayes, 1998, TMH.

**E books and online learning materials:**

1. [http://www.cse.iitm.ac.in/~vplab/courses/comp\\_org/LEC\\_INTRO.pdf](http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf)
2. <http://nptel.ac.in/courses/106103068/pdf/coa.pdf>

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/106103068/1>
2. <http://nptel.ac.in/courses/106103068/5>

**COURSE NAME: CAD FOR VLSI DESIGN**

**COURSE CODE: DEEC-14710**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 5%-10%**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

### **Course Outcomes**

On successful completion of this course, the students should be able to:

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
C01	Comprehend the VLSI design cycle, various design styles and basic concept of data structures & algorithms.	1(H)	1(H)
C02	Demonstrate the MOS fabrication process and different layout design rules.	1(M)	1(M)
CO3	Implement different Partitioning, Placement and constraints Graph algorithms.	3(M)	2(H)
CO4	Design solutions for problems related to flooplanning and routing algorithms	3(H)	3(M)
CO5	Apply the fundamental concepts of verilog language & various modeling and simulation in digital design system.	5(H)	2(M)
CO6	Analyze the various synthesis and scheduling algorithm in CAD VLSI.	2(H)	3(M)

### **Syllabus:**

**[Total Contact Hours: 39+13(T)=52]**

#### **Unit 1. Introduction**

**[8+3=11]**

Introduction to design methodologies, VLSI Design Cycle, Design styles: full-custom, standard-cell, gate-array and FPGA. Review of Data structures and algorithms, Review of VLSI Design automation tools, Algorithmic Graph Theory and Computational Complexity, Tractable and Intractable problems, general purpose methods for combinatorial optimization.

#### **Unit 2. Design Rules, Partitioning & Placement**

**[8+3=11]**

Review of MOS/CMOS Fabrication Technology, Layout Compaction, Design rules, problem formulation, algorithms for constraint graph compaction, placement and partitioning: Circuit

representation and problem formulation, Placement algorithms, Partitioning algorithms; Kernighan Lin (K-L) and FiducciaMattheyses (FM).

### **Unit 3. Floor Planning & Routing**

**[8+3=11]**

Floor planning concepts, shape functions and floor plan sizing, Types of local routing problems , Area routing, channel routing, global routing, overview of clock and power routing, algorithms for global routing.

### **Unit 4. Simulation**

**[7+2=9]**

Simulation, Gate-level modeling and simulation, Switch-level modeling and simulation, an overview of Verilog language.

### **Unit 5. Modelling and Synthesis**

**[8+2=10]**

Logic synthesis and verification, High level Synthesis, Hardware models, internal representation, Allocation, assignment and scheduling, Simple scheduling algorithm, Assignment problem, High level transformations.

#### **Text Books:**

1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Third Edition, Springer, 2013.
3. J. Bhasker, "Verilog VHDL synthesis: a practical primer", Star Galaxy publishing 1998.

#### **Reference books and other resources:**

1. Drechsler, Rolf, "Evolutionary Algorithms for VLSI CAD" Springer Science & Business Media, 1998.
2. Trimberger, Stephen M., "An Introduction to CAD for VLSI", Springer Science & Business Media, 1987.
3. Sadiq M. Sait and H. Youssef, "VLSI Physical Design Automation: Theory and Practice", World Scientific, 1999
4. Cormen, Thomas H., Charles E. Leiserson, and Ronald L. Rivest. "Introduction to Algorithms." The MIT Press, 3rd edition, 2009.
5. Steven M. Rubin, "Computer Aids for VLSI Design", Addison Wesley Publishing 1987.
6. D.D. Gajski, N.D. Dutt, A.C. Wu and A.Y. Yin, "High-level synthesis: introduction to chip and system design", Kluwer Academic Publishers, 1992.
7. M. Sarrafzadeh and C.K. Wong, "An introduction to physical design", McGraw Hill, 1996.
8. M. Sarrafzadeh and C.K. Wong, Introduction to VLSI Physical Design, Fourth Edition, McGraw-Hill., 1996.
9. Charles J. Alpert, Dinesh P. Mehta, Sachin S. Sapatnekar, Handbook of Algorithms for Physical Design Automation, Auerbach Publications (CRC Press), 2008.
10. S.K. Lim, Practical Problems in VLSI Physical Design Automation, Springer, 2008.

11. Palnitkar, Samir, “Verilog HDL”, Prentice Hall PTR, 2<sup>nd</sup> edition, 2003

**E books and online learning materials:**

1. [http://nptel.ac.in/courses/IIT-MADRAS/CAD\\_for\\_VLSI\\_Design\\_I/pdf/nptel-cad1-01.pdf](http://nptel.ac.in/courses/IIT-MADRAS/CAD_for_VLSI_Design_I/pdf/nptel-cad1-01.pdf)
2. <http://www.serc.iisc.ernet.in/~viren/Courses/2010/E0285/Lecture2.pdf>

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/106106088/1>
2. <http://nptel.ac.in/courses/106106088/6>



**COURSE NAME: WIRELESS SENSOR NETWORKS**

**COURSE CODE: DEEC-14711**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 10%-20%**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

**Course Outcomes**

On successful completion of this course, the students should be able to:

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
C01	Apply the knowledge of working principle of wireless sensor networks for utilization in different applications.	1(H)	1(M)
C02	Demonstrate the basic concept of wireless sensor network's architecture along with Constraints and Challenges of wireless sensor networks for utilization in different applications.	1(M)	1(M)
C03	Select and utilize the best topology control system for wireless sensor networks in different applications.	1(M)	1(L), 3(M)
C04	Demonstrate various Wireless Sensor Network platforms and tools.	3(H)	3(M)
C05	Design transceiver and protocol for Wireless Sensor Network.	5(H)	1(M)
C06	Describe the concept of VANET (Vehicular Adhoc Networks).	2(H)	1(H)

**Syllabus:** [ Total Contact Hours: 39+13(T)= 52]

**Unit 1. Introduction to Wireless Sensor Networks[9+3=12]**

Constraints and Challenges of sensor networks, Emerging technologies for wireless sensor networks, Node architecture, Hardware components overview, Energy consumption of Sensor nodes, Dynamic energy and power management on System level, some examples of Sensor nodes, Optimization goals and figures of merit, QOS, Energy Efficiency, scalability, robustness. Advantages of sensor networks, Sensor network applications.

**Unit 2. Topology Control [8+2=10]**

Location driven, Geographic Adaptive Fidelity (GAF), Geographic Random Forwarding (GeRaF),GEAR, Connectivity driven, SPAN, ASCENT.

**Unit 3 WSN Sensors [9+4=12]**

Physical Layer Design, Transceiver Design, MAC Protocols for WSN, Low Duty Cycle Protocols & Wakeup Concepts, S-MAC, Mediation Device Protocol, Wakeup Radio Concepts, Address & Name Management, Assignment of MAC Addresses, Routing Protocols, Energy Efficient Routing, Geographic Routing.

**Unit 4 WSN Platforms & Tools [8+2=10]**

Sensor Node Hardware, Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

**Unit 5 VANET (Vehicular Adhoc Networks)[5+2=7]**

Introduction and Motivation, V2X Communication Scenarios and Requirement, Architecture of ITS station, Regional Regulations.

**Text Books:**

1. Holger Karl & Andreas Willig, “ Protocol and Architecture for wireless sensor networks, John Wiley 2005.
2. Feng Zhao & Leonidas J. Guibas, “Wireless sensor Networks-An Information Processing Approach”, Elsevier,2007.
3. Riccardo Scopigno, AntonellaMolinaro, Claudia Campolo, “Vehicular ad hoc Networks: Standards, Solutions, and Research”, Springer, 2015.

**Reference Books:**

1. WalteneusDargie and Christian Poellabauer, “Fundamentals of Wireless Sensor Networks Theory and Practice”, John Wiley and Sons,first edition,2010.
2. Holger Karl & Andreas Willig, “Protocol and Architecture for wireless sensor networks, John Wiley 2007.

**E books and online learning materials:**

1. [http://cdn.intechopen.com/pdfs/38793/InTechOverview\\_of\\_wireless\\_sensor\\_network.pdf](http://cdn.intechopen.com/pdfs/38793/InTechOverview_of_wireless_sensor_network.pdf)
2. <http://image.sciencenet.cn/olddata/kexue.com.cn/bbs/upload/12615WSN-2007.pdf>

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/106105160/21>
2. <http://nptel.ac.in/courses/106105160/24>

**COURSE NAME: OPERATION RESEARCH**  
**COURSE CODE: DEEC-14712**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 80%-85%**

**Note:** The Question paper shall have three sections:

Section A shall consist of one question with 10 sub-questions of two (02) marks each. Section B shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. Section C shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of Section C may be sub-divided (if required) into two parts of five (05) marks each.

**Course Outcomes**

On successful completion of this course, the students should be able to:

CO	Definition	POs	PSOs
CO1	Be able to illustrate characteristics of different types of decision making environments and appropriate decision making approaches and tools to be used in each type	1(M)	2(M)
CO2	Solve linear programming problems using graphical method and simplex method	1(H), 3(L), 4(M) 12(L)	2(M)
CO3	Construct solution for solving transportation problem using transportation model.	1(M), 3(M)	2(M)
CO4	Apply Hungarian method to solve assignment problem.	1(M), 3(M), 5(L)	2(M)
CO5	Solve sequencing problems using Johnson's algorithm.	1(M), 3(M), 5(L)	2(M)
CO6	Apply dynamic programming for various problem solving fields.	1(M), 3(M)	2(M)
CO7	Implement games theory, which is mathematical theory for decision making.	1(M), 3(M)	2(M)

**Syllabus:**

**[Total Contact Hours: 40+13(T)= 53]**

**Unit 1. Introduction to Operation research**

**[5+2=7]**

Introduction, Historical Background, Scope of Operations Research , Features of Operations Research, Phases of Operations Research, Types of Operations Research Models, Operations

Research Methodology, Operations Research Techniques and Tools , Structure of the Mathematical Model, Limitations of Operations Research

**Unit 2. Linear Programming**

**[9+3=12]**

Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical Methods to Solve Linear Programming Problems, Applications, Advantages, Limitations Some Exceptional Cases, Standard Form of LPP, Fundamental theorem of LPP, Solution of LPP – Simplex Method, The Simplex Algorithm, Penalty Cost Method or Big M-method, Two Phase Method, Solved Problems on Minimisation, degeneracy and unbound solutions, procedure for resolving degenerate cases. Concept of duality, Importance of Duality Concepts, Formulation of Dual Problem, Economic Interpretation of Duality,

**Unit 3. Transportation Problem**

**[8+2=10]**

Formulation of transportation model, Optimality Methods, Unbalanced transportation problem, Basic feasible solution, Northwest corner rule, least cost method, Vogel's approximation method, MODI method. Applications of Transportation problems, Assignment Problem, Formulation, Hungarian method, unbalanced assignment problem, Travelling salesman problem.

**Unit 4. Sequencing Model**

**[6+2=8]**

Johnsons algorithm, Processing n Jobs through 2 Machines, Processing n Jobs through 3 Machines, Processing 2 Jobs through m machines, Processing n Jobs through m Machines, Graphical solutions priority rules.

**Unit 5. Dynamic Programming**

**[6+2=8]**

Characteristics of dynamic programming, Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.

**Unit 6. Games Theory**

**[6+2=8]**

Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for  $2 \times 2$  games.

**Text Books:**

1. Hamdy A. Taha, "Operations Research – An introduction", Prentice Hall, 8<sup>th</sup> Edition, 2007.
2. J K Sharma., "Operations Research Theory & Applications , Macmillan India Ltd , 3<sup>rd</sup> edition, , 2007.

**Reference books and other resources:**

1. A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2005.

2. P. K. Gupta and D. S. Hira, “Operations Research”, S. Chand & co., 2007

**E books and online learning materials:**

1. [http://164.100.133.129:81/econtent/Uploads/Operations\\_Research.pdf](http://164.100.133.129:81/econtent/Uploads/Operations_Research.pdf)

2. <http://public.tepper.cmu.edu/jnh/tutorialLSE.pdf>

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/112106134/1>

2. <http://nptel.ac.in/courses/112106134/3>

**COURSE NAME: MOBILE COMPUTING**

**COURSE CODE: DEEC-14713**

**Internal Marks: 40**

**L T P**

**External Marks: 60**

**3 1 -**

**Numerical & Design Problems Content: 20%-30%**

**Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

### **Course Outcomes**

On successful completion of this course, the students should be able to:

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
C01	Define overview of wireless telephony and issues in mobile computing.	1(M)	2(M)
C02	Develop channel structure, air interfaces and architecture of GSM.	3(M)	2(M)
CO3	Explain the mobile networks and protocols related to transport layer.	1(M)	2(M)
CO4	Define the wireless application protocol and overview of wireless LAN.	1(M)	2(L)
CO5	Describe the various algorithms related to mobile Adhoc networks	1(M)	2(M)
CO6	Explain various properties and architecture of Mobile Adhoc Networks	1(M)	2(M)

**Syllabus:** [Total Contact Hours:38+13(T)=51]

#### **Unit 1. Introduction[9+3=12]**

Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, frequency reuse, hand off strategies, channel assignment, channel interferences, GSM: services and features, GSM system architecture, GSM channel structure, air interfaces.

#### **Unit 2. Mobile Network & Transport Layer[10+3=13]**

Mobile IP Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, Dynamic Host Configuration Protocol

(DHCP), Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

**Unit 3. Wireless Networking [10+2=12]**

Wireless LAN Overview: MAC issues, IEEE 802.11, BlueTooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP:Architecture, protocol stack, application environment, applications.

**Unit 4. Mobile Ad hoc Networks [9+2=11]**

Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment, Mobile Ad hoc Networks (MANETs): Overview, architecture of MANET, Properties of a MANET, application of MANET, various routing algorithms, security in MANETs.

**Text Books:**

1. J. Schiller, Mobile Communications, Addison-Wesley, second edition, 2004.
2. Theodore S Rappaport , wireless communications : principles & practice, second edition, Pearson publications.

**Reference Books:**

1. Raj Pandya, Mobile & Personal Communication Systems and Service, PHI.
2. Asoke k Talukder ,Roopa R Yavagal, Mobile Computing , Technology, Application &Service Creation. Tata McGraw HillStojmenovic and Cacute, —Handbook of Wireless Networks and Mobile Computing||, Wiley, 2002.

**E books and online learning materials:**

1. <https://disco.ethz.ch/courses/ss04/mobicomp/lecture/1/Chapter1Introduction4Slides.pdf>
2. [https://www.cse.iitk.ac.in/users/rkg/Talks/mobile\\_main.pdf](https://www.cse.iitk.ac.in/users/rkg/Talks/mobile_main.pdf)

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/106106177/6>
2. <http://nptel.ac.in/courses/106106177/9>

**COURSE NAME: NUMERICAL METHODS IN ENGINEERING****COURSE CODE: DEEC-14714****Internal Marks: 40****L T P****External Marks: 60****3 1 -****Note: The Question paper shall have three sections:**

**Section A** shall consist of one question with 10 sub-questions of two (02) marks each. **Section B** shall consist of five questions of five (05) marks each, out of which four questions are required to be attempted by the candidate. **Section C** shall consist of three questions of ten (10) marks each, out of which two questions are required to be attempted by the candidate. Any question of **Section C** may be sub-divided (if required) into two parts of five (05) marks each.

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
C01	Analyze absolute, relative and percentage error.	1(H)	1(M)
C02	Solve the system of linear equations.	1(H) 5(H)	1(M)
CO3	Solve the system of non- linear equations.	1(H) 5(H)	1(M)
CO4	Solve the stability and fracture problems with the help of lowest eigen value.	1(H) 5(H)	1(M)
CO5	Solve the equations which have no solution using numerical integration.	1(H) 2(M) 3(H) 5 (H) 11(H)	1(M)
CO6	Solve first and second order ordinary differential equation.	1(M) 3(H) 5(H) 11(H)	1(M)

**Syllabus:****[Total Contact Hours: 42+14(T)= 56]****Unit 1. Error Analysis****[5+2=7]**

Exact and Approximate numbers, rounding of numbers, Significant digits, correct digits, various types of errors encountered in computations, Propagation of errors.

**Unit 2. Solution of system of linear equations****[6+2=8]**



(I) Direct/Indirect Methods: Gauss elimination method without pivoting and with pivoting, LU-decomposition method

(II) Iterative methods, Jacobi and Gauss-Seidal methods.

**Unit 3. Roots of Non linear equations** **[6+2=8]**

Bisection method, Regula-falsi method, Newton Raphson method, direct iterative method with convergence criteria, Newton Raphson method for solution of a pair of non linear equation.

**Unit 4. Eigen Values and Eigen Vectors** **[5+1=6]**

Dominant and Smallest values/Eigen vectors by power method.

**Unit 5. Interpolation** **[6+2=8]**

Finite Difference operator and their relationships, Difference tables, Newton, Bessel and Stirling interpolation formulae, Divided Differences, Lagrange's Interpolation and Newton's divided interpolation.

**Unit 6. First and second order derivative by various interpolation formulae.** **[4+1]**

**Unit 7. Numerical Integration** **[6+2=8]**

Trapezoidal, Simpson's 1/3 and 3/8 rule with errors and their combination, Boole's and Weddle Rule.

**Unit 8. Solution of first and second order ordinary differential equation** **[5+2=7]**

Picard's method, Taylor's series method, Euler's Method, Modified Euler's method-K method and Milne's Predictor-corrector method.

**Text Books:**

1. Jain M.K, Iyengar, S.R.K and Jain RK Numerical Methods for Scientific and Engg. Computation, New Age Pvt. Pub New Delhi.
2. Krishnamurthy, E.V and Sen, S.K., Applied Numerical Analysis East west Publication.
3. Rao V, Dukkupati, New Age International Publishers.

**Reference books:**

1. Gerald.C.F and Wheatly, P.O, Applied Numerical Analysis WESLEY
2. Conte, S.D and DeBoor, C., Elementary numerical Analysis, McGraw Hill Publisher.

**E books and online learning materials:**

1. <http://nptel.ac.in/courses/101108047/module6/Lecture%2015.pdf>
2. <http://nptel.ac.in/courses/104101002/downloads/lecture-notes/module1/chapter4.pdf>

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/122102009/1>
2. <http://nptel.ac.in/courses/122102009/2>

**COURSE NAME: LAB OPTICAL COMMUNICATION****COURSE CODE: EC-14715****Internal Marks: 30****L T P****External Marks: 20****- - 2****NOTE:** Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.**Course Outcomes**

On successful completion of this course, the students should be able to:

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
CO1	Demonstrate the working of optical fiber communication system and analyze the propagation and bending loss of fiber.	4(M), 5(H), 9(H), 10(H)	1(M)
CO2	Measure the numerical aperture, sensitivity and BER in optical fibers	2(H), 4(H), 10(H)	1(L)
CO3	Demonstrate and measurement of sensitivity of the fiber optic link	1(L),4(H),10(H)	1(L)
CO4	Comprehend the voice Transmission through optical fiber using PWM.	1(L), 4(M) 10(H)	1(L)
CO5	Understand the V-I characteristics of LED and photo detector.	2(H), 4(H), 10(H)	1(L)
CO6	Work in a team to demonstrate transmission of WDM signal through optical fiber using Optisystem.	4(H), 9(H), 12(H)	1(M), 2(M)

**Syllabus:**

- Experiment 1.** To demonstrate fiber optic analog and digital link.
- Experiment 2.** To Study and measurement of propagation loss in optical fiber.
- Experiment 3.** To demonstrate and measurement of bending loss in optical fiber.
- Experiment 4.** To demonstrate and measurement of numerical aperture of optical fiber.
- Experiment 5.** To Measure the optical power using optical power meter.
- Experiment 6.** To demonstrate Voice Transmission through optical fiber using PWM.
- Experiment 7.** To measure the sensitivity of the fiber optic link.
- Experiment 8.** To demonstrate V-I characteristics of fiber optic LEDs.
- Experiment 9.** To demonstrate V-I characteristics of photo detector.
- Experiment 10.** To demonstrate transmission of WDM signal through optical fiber using Optisystem.

**Reference Books and Other Resources:**

Lab manuals available in lab.

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/114101002/2>
2. <http://nptel.ac.in/courses/114101002/12>

**COURSE NAME: LAB VLSI DESIGN**

**COURSE CODE: EC-14716**

**Internal Marks: 30**

**L T P**

**External Marks: 20**

**- - 2**

**NOTE:** Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

### **Course Outcomes**

On successful completion of this course, the students should be able to:

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
CO1	Apply knowledge of VHDL for modeling and functional verification of digital circuits.	1(H), 5(H)	3(H)
CO2	Develop VHDL codes for combinational and sequential circuits under given specifications.	1(H)	3(M)
CO3	Examine the simulated waveforms for different inputs to digital circuits.	1(H), 2(M)	3(L)
CO4	Design digital circuits for given specifications using VHDL tool.	1(H), 3(H), 5(H)	3(H)
CO5	Demonstrate the operation of digital circuits on FPGA/CPLD kits.	1(H), 5(H)	3(H)
CO6	Work in a team to construct program for given engineering problem and test it on kits for enhanced learning.	1(H), 2(H), 4(H), 5(H), 9(M), 12(H)	3(H)

### **Syllabus:**

Perform the following experiments using VHDL:

- Experiment 1.** Design of gates: AND, OR, NOT, NAND and NOR.
- Experiment 2.** Design of Half-Adder and Full Adder.
- Experiment 3.** Design of Half Subtractor and Full Subtractor.
- Experiment 4.** Design of 4:1 MUX.
- Experiment 5.** Design of 1:8 DEMUX.
- Experiment 6.** Design of 3:8 Decoder.
- Experiment 7.** Design of 8:3 Priority Encoder.
- Experiment 8.** Design of 4 Bit Binary to Grey code Converter.
- Experiment 9.** Design of 4 Bit Binary to BCD Converter using sequential statement.
- Experiment 10.** Design of 4-Bit Binary to Excess-3 converter using sequential statement.
- Experiment 11.** Design of 9-Bit parity generator using structural style.
- Experiment 12.** Design of 4-bit comparator.

- Experiment 13.** Design of all type of Flip-Flops using sequential statements.
- Experiment 14.** Design of 8-Bit Shift Register.
- Experiment 15.** Design of Synchronous 8-bit Johnson Counter.
- Experiment 16.** Design of Synchronous 8-Bit universal shift register.
- Experiment 17.** Design of counters: MOD 5, MOD 16.
- Experiment 18.** Design of a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.
- Experiment 19.** Study of FPGA/CPLD universal kits.
- Experiment 20.** Implementation of 1:4 DEMUX on FPGA kit.

**Reference Books and Other Resources:**

Lab manuals available in lab.

**MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/117101058/2>
2. <http://nptel.ac.in/courses/117101058/12>

**COURSE NAME: MAJOR PROJECT**

**COURSE CODE: PREC-14701**

**Internal Marks: 120**

**External Marks: 80**

**L T P**

**- - 3**

### **Course Outcomes**

On successful completion of this course, the students should be able to:

<b>CO</b>	<b>Definition</b>	<b>POs</b>	<b>PSOs</b>
C01	To apply knowledge of electronics and communication field to identify, collect relevant literature and analyze the information to formulate the problem definition for project.	1(H), 2(H), 4(M)	1(H), 2(H), 3(H)
C02	Demonstrate ethical principles in project planning, execution and documentation.	8(H), 11(M)	1(H), 2(H), 3(H)
C03	Select and utilize appropriate <b>tools</b> to implement and demonstrate the proposed project.	5(H)	1(H), 2(H), 3(H)
C04	Design and develop sustainable solution/system for the improvement of environment conditions and betterment of the society.	3(H), 6(H), 7(H)	1(H), 2(H), 3(H)
C05	Communicate effectively on developed solution/system with engineering community as individual or team through effective presentation and report writing.	9(H),10(H), 11(M)	1(H), 2(H), 3(H)
C06	Develop sustainable system with scope for enhancement and continue life-long learning	12(H)	1(H), 2(H), 3(H)

### **Syllabus:**

Students may choose a project based on any subject of Electronics and Communication Engineering. The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports. Evaluation of the project work shall be done as per the approved Rubrics.

### **Reference Books and Other Resources:**

Various projects based magazines available in the college/department library.

### **MOOCS and Video Course:**

1. <http://nptel.ac.in/courses/117101105/>
2. <http://nptel.ac.in/courses/117101002/>