University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur Campus

8th Semester Syllabus for B.Tech ECE Admission Batch 2022

Index:

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1.	ECEL	PEEC801	**Program Elective-6** A. Fiber Optic Communication B. Electronic Measurement	3	0	0	3	3
2.	ECEL	PEEC802	**Program Elective-7** A. Sensors & Transducers B. Antenna and Propagation Theory	3	0	0	3	3
3.	OEC	OEEC803	**Open Elective-4** A. Organizational Behavior B. Cyber Security	3	0	0	3	3
4.	OEC	OEEC804	**Open Elective-5** A. Big Data Analysis B. Optimization Technique	3	0	0	3	3
5	ECEL	PEEC892	A. Sensors & Transducers Lab **B.** Antenna and Propagation Lab	0	0	2	2	1
6.	GSC	ESP 802	ESP VIII	1	0	0	1	0.5
7.	GSC	SDP 882	SDP VIII	0	0	1	1	0.5
8.	ECP	PRJECE 881	Project Work – II & Dissertation	-	-	-	5	6
9.	CC	ECE 891	GRAND VIVA	-	-	-	-	3
10	Mandatory	Internship II	Internship					4

11.	Mandatory Course	MAR 881	Mandatory Additional Requirement (MAR)	0	0	0	0	0
		IFC	Industry and Foreign Certification	0	0	0	0	0
Total Credit Points =								**27**

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Subject Name: Fiber Optic Communication

Credit: 3

Lecture Hours: 33

Subject Code: PEEC801A

Link for study material: https://classroom.google.com/c/NjQ3MTU0ODU2ODQx

Link for Coursera Course:
https://www.coursera.org/specializations/optical-engineering\

Link for Linkedin Course: https://www.linkedin.com/learning/electrical-systems-communications-and-data

Course Objective:

CO1: To learn the basic elements of optical fiber transmission.

CO2: To understand the different kind optical sources.

CO3: To learn the various optical switches.

CO4: To learn about WDM, DWDM systems and to learn about nonlinear effects, modulation and solitone based communication.

Course Outcome:

At the end of the course, students will demonstrate the ability to:

1. Understand the principles fiber-optic communication, the components and the bandwidth advantages and built up mathematical concept of Optical fundamentals.
2. Understand the properties of the optical fibers and optical components and fabrication of optical fiber.
3. Understand operation of lasers, LEDs, and detectors, Optical switches
4. Understand WDM and DWDM systems and networks. Understand non-linear effects in optical fibers

Detailed Syllabus

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Introduction**	Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.	***International Academia:*** 1. https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/fiberoptics-fundamentals/ 2. https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/0559e0c48d1e0626368674fd985d2b61_MIT6_013S09_chap12.pdf ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf)	3	No Lab

			Industry Mapping: COMSOL Multiphysics, MATLAB with AI Toolbox		
2	**Fibre basics**	Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.	**International Standards :** 1. https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/fiberoptics-fundamentals/ 2. https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/0559e0c48d1e0626368674fd985d2b61_MIT6_013S09_chap12.pdf ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** COMSOL Multiphysics, MATLAB with AI Toolbox	6	No Lab

3	**Optical sources, detectors and links**	Optical sources - LEDs and Lasers, Photo-detectors - pin-detectors, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.	***International Standards*** : 1. https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/fiberoptics-fundamentals/ 2. https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/0559e0c48d1e0626368674fd985d2b61_MIT6_013S09_chap12.pdf ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** COMSOL Multiphysics, MATLAB with AI Toolbox	7	No Lab
4	**Optical switches**	Optical switches - coupled mode analysis of directional couplers, electro-optic switches	***International Standards:*** 1. https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/fiberoptics-fundamentals/ 2. https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/0559e0c48d1e0626368674fd985d2b61_MIT6_013S09_chap12.pdf ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf	7	No Lab

			) ***Industry Mapping:*** COMSOL Multiphysics, MATLAB with AI Toolbox		
5	Nonlinear effects, modulation, dispersion	Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solition based communication.	***International Standards:*** 1. https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/fiberoptics-fundamentals/ 2. https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/0559e0c48d1e0626368674fd985d2b61_MIT6_013S09_chap12.pdf ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** COMSOL Multiphysics, MATLAB with AI Toolbox	4	No Lab
6	**Optical amplifiers**	Optical amplifiers - EDFA, Raman amplifier, Coherent communication and WDM systems.	***International Standards:*** 1. https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/fiberoptics-fundamentals/ 2. https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/0559e0c48d1e0626368674fd985d2b61_MIT6_013S09_chap12.pdf ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf	5	No Lab

			) ***Industry Mapping:*** COMSOL Multiphysics, MATLAB with AI Toolbox		
7	**Gen AI in Fiber Optics**	Applications and future scopes. Introduction to Gen AI tools used in FOC.	***International Standards:*** 1. https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/fiberoptics-fundamentals/ 2. https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/0559e0c48d1e0626368674fd985d2b61_MIT6_013S09_chap12.pdf ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** COMSOL Multiphysics, MATLAB with AI Toolbox	2	No Lab

Text Books

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 2nd Ed. 1992.

2. John M Senior," Optical Fiber Communications Principles and Practice", Pearson 3rd Edition

Reference Books

1. J.E. Midwinter, Optical fibers for transmission, John Wiley, 1979.

2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.

3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.

4. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1992

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Subject Name: ELECTRONIC MEASUREMENT
Subject Code: PEEC801B
Credit: 3

Lecture Hours: 33

Prerequisites: Basic knowledge about components, Resistors, Inductors, Capacitors; Network Theorems; Basic knowledge about the operation of Semiconductor devices (Transistor, Diode etc.); Analog Electronics.

Course Objective:

The course aims to provide students with a solid foundation in the principles and practices of electronic measurements, enabling them to select and utilize appropriate instruments for various electrical and non-electrical parameters and to analyze measurement data effectively.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Classify the instrumentation and measurement system, identify performance characteristics, and analyze various measurement errors.

CO2: Choose appropriate analog and digital instruments for the measurement of electrical quantities (voltage, current, power, energy, frequency).
CO3: Evaluate different resistance, inductance, and capacitance measuring methods using various AC and DC bridges and the Q-meter.
CO4: Analyze the fundamental operation and applications of oscilloscopes (CRO, DSO)

Link for Coursera Course:

i) https://www.coursera.org/learn/sensors-circuit-interface

ii) https://www.coursera.org/specializations/sensor-technologies-for-biomedical-applications

iii) https://www.coursera.org/learn/sensors-circuit-interface

Link for LinkedIn Learning Course:

https://www.linkedin.com/learning/electronics-foundations-fundamentals/the-fundamentals-of-electronics?ga_campid.11663861480_asid.114329355340_crid.481097052948_kw.linkedin%2Blearning%2Bcourses_d.c_tid.kwd-336730500916_n.g_mt.e_geo.9061848

Link for Study Material:

https://docs.google.com/document/d/1ddSllqH4QdT-WaNGpzAOAx14gIh_InQF/edit?usp=drive_link&ouid=116508199826018918971&rtpof=true&sd=true

Link for NPTEL Course:

i) https://onlinecourses.nptel.ac.in/noc26_ee29/preview

ii) https://onlinecourses.nptel.ac.in/noc26_ee01/preview

iii) https://onlinecourses.nptel.ac.in/noc26_bt07/preview

Link for Infosys Springboard Course:

https://infyspringboard.onwingspan.com/web/en/page/lex_auth_01398121720035737617

Detailed Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
	Fundamentals of Measurement and Analog Instruments **Text book:** David A Bell (Chapter 5)	Generalized measurement system, static and dynamic characteristics, types of errors and their statistical analysis, calibration methods, PMMC, moving iron, electrodynamometer instruments, and extension of instrument ranges (shunts and multipliers).	As per International Standards : (https://explorecourses.stanford.edu/print?q=EE&descriptions=on&academicYear=20222023&filter-coursestatus-Active=on&catalog=) and AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:***LT-SPICE software, Proteus, Matlab_Simulink.	6	No Lab

2.	**AC & DC Bridges and Impedance Measurement** **Text book :** David A Bell (Chapter 8 and 10)	-DC bridges (Wheatstone, Kelvin double bridge), AC bridges (Maxwell's, Hay's, Schering, Wien bridges) for measurement of resistance, inductance, and capacitance, and the use of Q-meter.	As per International Standards : (https://explorecourses.stanford.edu/print?q=EE&descriptions=on&academicYear=20222023&filter-coursestatus-Active=on&catalog=) and AICTE-prescribed syllabus : :(https://www.aicte-india.org/sites/default/files /Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:*** LT-SPICE software, Proteus, Matlab_Simulink	6	No Lab

3	**Cathode Ray Oscilloscope (CRO) and Signal Generators** **Text Book:** H S Kalsi (Chapter 7 and 8))	Block diagram of RO, time base rcuits, deflection ystems, probes, easurement of oltage, current, equency, and phase sing Lissajous gures, and special urpose oscilloscopes lual trace, storage, igital storage). ignal generators: ne wave, function, ulse, and sweep equency generators	As per International Standards : (https://explorecourses.stanford.edu/print?q=EE&descriptions=on&academicYear=20222023&filter-coursestatus-Active=on&catalog=) and AICTE-prescribed syllabus : :(https://www.aicte-india.org/sites/default/files /Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:***LT-SPICE software, Proteus, Matlab_Simulink.	6	No Lab

4	**Digital Instruments and Signal Analysis** **Text Book:** David A Bell (Chapter 6)	-Advantages of digital over analog instruments, digital voltmeters (ramp, dual-slope integration, successive approximation types), digital multimeters, frequency counters, and signal analyzers (wave analyzers, spectrum analyzers, harmonic distortion analyzers).	As per International Standards : https://explorecourses.stanford.edu/print?q=EE&descriptions=on&academicYear=20222023&filter-coursestatus-Active=on&catalog=) and AICTE-prescribed syllabus : (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) ***Industry Mapping:***LT-SPICE software, Proteus, Matlab_Simulink.	6	No Lab
5	**Transducers and Data Acquisition** **Text Book:** i) **David A Bell**	-Classification and selection criteria for transducers (active/passive), working principles and applications of strain gauges, LVDT,	As per International Standards : https://explorecourses.stanford.edu/print?q=EE&descriptions=on&academicYear=2022202	5	No Lab

	(Chapter 18) ii) **H S Kalsi (Chapter 17)**	RTD, thermistors, thermocouples, piezoelectric transducers, and an introduction to data acquisition systems (DAS).	3&filter-coursestatus-Active=on&catalog=) and AICTE-prescribed syllabus : (https://www.aicte-india.org/sites/default/files /Model_Curriculum/Final_ECE.pdf), Industry Mapping: LT-SPICE software, LabView, Proteus. Hardware Chipset: IC741, IC328.		
6	**Application of GEN AI Tools for Analysis and Design of Simple Measuring Instrument** **Text Book:** **From Net**	-Introduction of GEN AI -Use of GEN AI for Analysis of Electronic Instruments - Use of GEN AI for Design of Simple Electronic Instruments.	https://in.mathworks.com/solutions/artificial-intelligence.html	3	No Lab

Text book and Reference books:

Text Book:

1. A Course in Electrical and Electronic Measurements and Instrumentation, A K Sawhney, Dhanpat Rai & Co, Reprint, 2013
2. Electronic Instrumentation, H S Kalsi, 3rd Edition, TMH.
3. Electronic Instrumentation &Measurements, David A. Bell, 3rd Edition, Oxford University press.

Reference Books:

1. Modern Electronic Instrumentation and Measurement Techniques, Helfrick & Cooper, 2nd Edition, PHI.

2. Elements of electronic instrumentation and measurement, Joseph J. Carr, 3rd Edition

3. V.R.Moorthi, “Power Electronics”, Oxford University Press.

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Subject Name: Sensors & Transducers

Subject Code: PEEC802A

Credit: 3

Lecture Hours: 38

Course Objective:

1. To understand the concepts of measurement system.
2. To impart the principles and working modes of various types of Resistive, Inductive, Capacitive, Piezoelectric and Special transducers.
3. To give an idea about the applications of various transducers and selection criteria of a transducer for a particular application.
4. To learn the fundamentals of signal conditioning, data acquisition techniques and communication systems used in developing measurement system.

Course Outcome:

CO1: Students will acquire a knowledge about basic principles of transducers and smart sensors.

CO2: After completing this course, students will be able to apply the knowledge of transducers and sensors to comprehend digital instrumentation systems.

CO3: Students will acquire a knowledge about performance of different sensors for various applications.

CO4: Students will be able to design a system using appropriate sensors for a particular application.

1. **Link for LinkedIn Courses:**

   i) **https://www.linkedin.com/learning/iot-foundations-fundamentals/sensors?trk=learning-serp_learning-search-card_search-card&upsellOrderOrigin=sem-ga_campid.11663861480_asid.114329355340_crid.481097052948_kw.linkedin%2Blearning%2Bcourses_d.c_tid.kwd-336730500916_n.g_mt.e_geo.9061848**

2. **Link for Coursera Courses:**

   I) **https://www.coursera.org/learn/pressure-force-motion-humidity-sensors**

   II) **https://www.coursera.org/learn/electric-vehicle-sensors**

3. **Link for Study Material:**

   i) **https://drive.google.com/drive/folders/1MsvI8flatkyqbeCcM3_PSz7EYQWUPteK?usp=sharing**

Detailed Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Introduction** **Text Book:** Sensors & transducers, D. Patranabis (Chapter 1)	Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.	***International Academia:*** (https://online.stanford.edu/courses/me220-introduction-sensors) ***AICTE-prescribed syllabus:*** **(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Mechatronics/mechatronics.pdf)** ***Industry Mapping:*** LT-SPICE software, Proteus, Matlab_Simulink.	6	

2	**Resistive Trans-ducers:** **Text Book:** Sensors & transducers, D. Patranabis (Chapter 1)	Definition of a transducer, Block Diagram, Active and Passive Transducers, Advantages of Electrical transducers. **Resistive Transducers:** Potentiometers: Characteristics, Loading effect, and problems. **Strain gauge:** Theory, Types, applications and problems. **Thermistor, RTD:** Theory, Applications and Problems.	***International Academia:*** (https://online.stanford.edu/courses/me220-introduction-sensors) ***AICTE-prescribed syllabus:*** **(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Mechatronics/mechatronics.pdf)** ***Industry Mapping:*** NXP® Sensor Toolbox **https://www.nxp.com/design/design-center/software/sensor-toolbox:SENSOR-TOOLBOXX**	6	1. **Measure Force using a Strain Gauge** for torque and load monitoring in industrial equipment and robotic arms. 2. **Monitor and Control Temperature** using an RTD (Resistance Temperature Detector) to ensure consistent process conditions in industrial environments. 3. **Measure Temperature** using a thermistor, with applications

					in automation processes for industrial operations.
3	**Displacement, Capacitive and Inductive Transducers:** **Text Book:** Sensors & transducers, D. Patranabis (Chapter 2, 4)	**-LVDT**: Characteristics, Practical applications and problems. -Capacitive Transducers: Capacitive transducers using change in area of plates, distance between plates and change of dielectric constants, Applications of Capacitive Transducers and problems. -Inductive Transducers:	**International Standards** :(https://online.stanford.edu/courses/me220-introduction-sensors) ***AICTE prescribed syllabus:*** **(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Mechatronics/mechatronics.pdf)** ***Industry Mapping:*** ***Industry Mapping:*** LT-SPICE software, Proteus, Matlab_Simulink.	6	1. **Control Object Position** using an LVDT for precise movement in automated assembly lines. 2. **Detect and Measure Speed** in machinery using an inductive proximity sensor for automation in industrial processes.

		Sensitivity and Linearity of the Transducers, Ferromagnetic Plunger Type Transducers			3. **Measure Liquid Level** in a tank using a capacitive proximity sensor, focusing on its application for automation systems in industries.
4	**Thermocouple and Piezo-electric Transducers:** **Text Book:** Sensors & transducers, D. Patranabis (Chapter 2, 3, 4, 7)	**Thermocouple:** Measurement of thermocouple output, compensating circuits, lead compensation, advantages and disadvantages of thermocouple. **Piezo-electric Transducers:** Principles of operation,	***International Standards*** : (https://online.stanford.edu/courses/me220-introduction-sensors) ***AICTE prescribed syllabus:*** **(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Mechatronics/mechatronics.pdf)** ***Industry Mapping:*** LT-SPICE software, Proteus, Matlab-Simulink.	6	**1. Use a Thermo-couple for Temperature Sensing** to automate switching between two industrial processes. **2. Measure**

		expression for output voltage, Piezo-electric materials, equivalent circuit, loading effect, and Problems. -**Magnetic Sensors:** Introduction, Sensors and the Principles Behind. **Special Transducers:** Introduction to MEMS Sensors and Nano Sensors, Schematic of the design of sensor, applications. -Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters.			**Pressure** of liquid in a tank using a piezo-resistive sensor, with applications in feedback control for industrial processes.

5	**Optical Trans-ducers:** **Text Book:** Sensors & transducers, D. Patranabis (Chapter 5)	Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors	***International Standards:*** (https://online.stanford.edu/courses/me220-introduction-sensors) ***AICTE prescribed syllabus:*** **(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Mechatronics/mechatronics.pdf)** ***Industry Mapping:*** LT-SPICE software, Proteus, Matlab-Simulink.	6	1. **Test Optical Sensors and Opto-Couplers** for their role in signal isolation and noise reduction in high-speed industrial systems.
6	**Signal Conditioning and Data Acquisition System:** **Text Book:** Class notes and Study Material)	**Signal Conditioning:** Amplification – Filtering – Sample and Hold circuits. **Data Acquisition**: i) Introduction to Data Acquisition System,	***International Standards:*** (https://online.stanford.edu/courses/me220-introduction-sensors) ***AICTE prescribed syllabus:*** **(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Mechatronics/mechatronics.pdf)** ***Industry Mapping:*** LT-SPICE software, Proteus, Matlab-Simulink.	6	1. **Design and Implement Signal Conditioning Circuits** using Op-Amps to linearize the sensor output for accurate force measurement

		ii) Essential components of data acquisition system.			in process industries. 2. **Set Up an 8-Channel Data Acquisition System** to collect, process, and analyze real-time data for predictive maintenance in industrial setups.
7	**Application of GEN AI Tools for Analysis and performance of different sensors in Industries:**	-Introduction of GEN AI -Use of GEN AI for Analysis of Sensor/Transducer based Electronic Circuits.	***https://in.mathworks.com/products/sensor-fusion-and-tracking.html***	2	

	Research papers and study material	- Use of GEN AI for Design of Sensor/Transducer based Electronic Circuits			

Learning Resources:

Text Book:

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI

Reference Book:

1. Sensors and Signal Conditioning; Ramón Pallás-Areny, John G. Webster
2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill

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Subject Name: Antenna and Propagation Theory
Subject Code: PEEC802B
Credit: 3
Lecture Hours: 40

Pre-requisite: Electromagnetic Waves, Microwave Theory and Techniques.

Coursera link: https://www.coursera.org/learn/microwave-antenna

Linked link: https://www.linkedin.com/learning/introduction-to-telecommunications-standards-networks-and-innovations/antenna-basics-types?resume=false

NPTEL link: https://nptel.ac.in/courses/108101092

Course Objectives:

1. To introduce the fundamental electromagnetic principles that form the basis of antenna theory.
2. To develop an understanding of antenna characteristics.
3. To familiarize students with different antenna structures and arrays.
4. To enable students to analyze radiation fields and array behavior.
5. To provide a comprehensive understanding of radio wave propagation mechanisms

Course Outcome (CO):

CO1: Students would be able to understand basic electromagnetic principles and analyze the fundamentals of antenna theory.

CO2: Students would be able to understand antenna arrays and radiation properties of antennas.

CO3: Students would be able to understand the characteristic properties of different types of antennas with their applications and respective radiation mechanism.

CO4: Students would be able to apprehend and analyze the atmospheric and terrestrial effects on radio wave propagation.

Module number	Topic	Sub-Topics	Mapping with Industry and International Academia	Lecture Hours

1	**Introduction to Antenna Characteristics**	Review of Maxwell's Equation; Radiation of e.m waves and introducing Antenna; Vector Potential and Retarded Vector Potential; Radiation fields of a Hertzian dipole(electric); Duality Principle, Radiation fields due to short magnetic dipole. Antenna Characteristics: Radiation Pattern, Beam Width; Radiation Resistance and efficiency; Directivity and Gain; Impedance, VSWR, Polarization; Effective height and Receive Aperture; Noise Temperature of Antenna.	***International Academia:*** (https://ocw.mit.edu/courses/res-ll-002-adaptive-antennas-and-phased-arrays-spring-2010/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** software: Matlab, CST/ HFSS.	8
2	**Radiation fields and Characteristics and Antenna Arrays.**	**A.** Radiation fields and Characteristics of λ/2 dipole; discussion on λ/4 monopole antenna; Current distribution and Radiation patterns of center-fed dipoles of length λ, 3λ/2 and 2 λ. Horizontal and Vertical antennas over a plane ground. **B.** Antenna Arrays: electric Field due to 2 element arrays, 3 element Arrays; Pattern Multiplication; Uniform Linear Array: End fire and Broad side; Phased array.	**International Standards** : (https://ocw.mit.edu/courses/res-ll-002-adaptive-antennas-and-phased-arrays-spring-2010/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: Matlab, CST/ HFSS.	12

3	**Characteristics and properties**	Characteristics and properties of :Travelling Wave Antenna, Helical Antenna, Folded Dipole, Yagi-Uda Array, Loop Antenna, Electrically Short Antennas, Broad Band Antenna (Log periodic Antenna), Microstrip Patch Antenna. Radiation from an aperture: Sectoral and Pyramidal Horn Antennas, Design of Optimum Horn Antenna; Parabolic and Corner Reflectors and feed systems. [Major stress on Characteristics features, applications (including frequency at which used), advantages and disadvantages, major design principles and equations (without long and detailed derivations].	***International Standards*** : (https://ocw.mit.edu/courses/res-ll-002-adaptive-antennas-and-phased-arrays-spring-2010/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:*** Software: Matlab, CST/ HFSS.	12
4	**Ground Wave Propagation**	Methods of Propagation: Ground Wave Propagation, Components of ground wave, Field strength dependence on physical factors. Sky wave Propagation; Ionospheric Layers; Virtual Height, Critical Frequency, MUF, Skip distance, Sporadic Reflections. Space wave propagation: Tropospheric Scatter, Ducting Super refraction, Sub refraction. Friss Transmission Formula, SNR of a Radio Link. Physical (Medium) effects on Radio wave Propagation: Absorption, Refraction and Radio Horizon, Diffraction, Multipath Propagation and fading, Noise, Doppler effect.	***International Standards:*** (https://ocw.mit.edu/courses/res-ll-002-adaptive-antennas-and-phased-arrays-spring-2010/) ***AICTE prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Model_Curriculum/UG-1/ug-vol1.pdf) ***Industry Mapping:***	8

			Hardware: Yagi - Uda Antenna, Horn Antenna, Folded Dipole Antenna, Dipole Antenna. Software: Matlab, CST/ HFSS	

Text Books:

1. Antennas and Wave Propagation by G. S. N. Raju", 4th ed., Oxford university pub.
1. Antenna (for all application), John D. Kraus and Ronald J. Marhcfka; Tata- MacGraw Hill, 3rd Edition
2. Antenna & Wave Propagation, K.D Prasad; Satya Prakashan, New Delhi, 3rd Edition
3. Antenna Theory: Analysis & Design, Constantine A. Balanis; Willey, 3rd Edition

Reference Book

1. Elements of Electromagnetics; Mathew N.O. Sadiku, Oxford University Press, 5th Edition(2010)
2. Electromagnetic Waves & Radiating Systems, EC Jordan & K.G. Balmain; Pearson Education, 2nd Edition (2009)
3. Microstrip Antenna Design Handbook- Ramesh Garg; Artech House (2001)

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Subject Name: Organizational Behaviour

Subject Code: OEEC803A

Lecture Hours: 40

Credit: 3

Coursera **NPTEL** **LinkedIn Learning**

Detailed syllabus

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Concept of organizational behavior**	Introduction: Concept of organizational behavior – Learning Objectives, Nature, Role, importance, Emerging Challenges, Evolution.	***International Academia:*** https://ocw.mit.edu/cour ses/15-668-people-and- organizations-fall-2010/pages/lecture- notes/ ***Industry Mapping:*** Organizational Dynamics Workplace Behavior Corporate Culture	5	1. Case Study on concepts of organizational behavior.

2	**Behavioral Dynamics**	Personality: Learning Objectives, Nature, Theories, Shaping of Personalities Perception and Attribution: Meaning, Definitions, Influencing factors, Perceptual process	***International Academia: (https://ocw.mit.edu/cou rses/15-668-people-and- organizations-fall-2010/pages/lecture- notes/)*** ***Industry Mapping: Behavioral Dynamic, Personality Alignment, Perception Integration***	5	2. Case Study on concepts of perceptions and personality differences
3	**Learning cognition in organizations**	Learning: Definition, Process, Cognitive theory of learning Attitudes: Definition, Objective, Nature, Components-ABC model, Formation, Function, Challenging attitudes	***International Standards :(https://ocw.mit.edu/cours es/15-341-individuals- groups-and-organizations-fall-2006/pages/readings/)*** ***Industry Mapping: Learning Synergy Group Learning Dynamics Collaborative Learning***	5	3. Case Study on concepts of learning

4	**Group Dynamics**	Group Dynamics: Definition, Objective, Types, Introduction to Group Development and Structuring.	***International Standards :(https://ocw.mit.edu/cours es/15-341-individuals- groups-and-organizations-fall-2006/pages/readings/)*** ***Industry Mapping: Team Dynamics Group Interaction Collective Behavior***	5	4. Case Study on concepts of group dynamics.
5	**Power and conflict**	Power and Political behavior: Definition, Power Dynamics, Sources, Power tactics, Essence of politics, Types of political activities Conflicts: Definition, Objective, Nature, Nature of conflicts, Process, levels	***International Standards : (https://ocw.mit.edu/course s/15-341-individuals- groups-and-organizations-fall-2006/pages/readings/)*** ***Industry Mapping: Power Dynamics Conflict Resolution Influence Management***	10	5. Case Study on concepts of power dynamics and conflict resolution in organizations.

6	**Organizational Communication**	Communication: Definition, Objective, Types of Interpersonal Communication, Influencing factors, Barriers. International Organizational Behavior.	***International Standards: (https://ocw.mit.edu/course s/15-341-individuals- groups-and-organizations-fall-2006/pages/readings/)*** ***Industry Mapping: Corporate Communication Organizational Messaging Business Discourse***	10	6. Case Study on concepts of organizational communication

Text Books:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.
3. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.

University of Engineering & Management, Jaipur

Subject Name: Cyber Security

Subject Code: OECEC803B

Credit: 3

Lecture Hours: 38

Pre-requisite: Basic knowledge of Data Structures, Digital Electronics

LinkedIn Learning Courses:

1. Introductory Cyber Security: Nail Your Cybersecurity Interview | LinkedIn Learning
2. Cyber Security Foundations: https://www.linkedin.com/learning/cybersecurity-foundations-22006082
3. Malware Analysis: Ethical Hacking: The Complete Malware Analysis Process | LinkedIn Learning
4. Cyber Security: Building the Ultimate Cybersecurity Lab and Cyber Range | LinkedIn Learning
5. Cryptography: Keeping information safe | LinkedIn Learning
6. Web Security: Verify identity and access privileges | LinkedIn Learning
7. Application Security: Learn to secure applications | LinkedIn Learning
8. Malware Analysis: Understanding what malware is and how it behaves | LinkedIn Learning

Coursera Courses:

1. Foundations of Cyber Security: Introduction to Cybersecurity Tools & Cyberattacks | Coursera
2. Cyber Security (by Google): Google Cybersecurity Professional Certificate | Coursera
3. Cyber Security Analyst: Microsoft Cybersecurity Analyst Professional Certificate | Coursera

Infosys Spring Board Courses:

1. TOC - Introduction to Cyber Security | Infosys Springboard

1	**Introduction and basic terminology**	Cyber Security and CIA Triad, basic cyber threats to CIA, cyber-attack surfaces, recent cyber-security incidents and their high-level analysis	*International Academia: Syllabus | Network and Computer Security | Electrical Engineering and Computer Science* *| MIT* *OpenCourseWare* *AICTE-prescribed syllabus:* *Industry Mapping: https://www.linkedin.com/learning/cyb*	**3**	1. Example Driven Lectures with examples drawn from most recent incidents Assignment 1: Google Dorking - Here we see how we gather information using Browser Assignment 2: Setup Cybersecurity Lab - Here we setup kali linux machine on our windows. Assignment 3: Learning Basic Linux commands. - Here we can see how we can use Linux.

			ersec urit y-foundations-22006082		Assignment 4: Identify Your Digital Footprint. - Learn about personal cybersecurity risks. Tools: Google, DuckDuckGo, VMware, Kali Linux.

2	**Basic Cryptography**	Role of Cryptography in ensuring confidentiality for data at rest, data in motion, and data in process. Symmetric and Asymmetric Cryptography, their needs as complementary of each other, some basic symmetric and asymmetric algorithm outlines (RSA, DH, DES, AES) Role of cryptography in data integrity, non-repudiation Hashing and Digital Signature and some example hash function outlines (MD5, SHA-256), understanding digital signature and its role. Digital Certificate and PKI. Importance of the role of a proper Pseudo Random Number Generator	*International Standards:* *Advanced Topics in Cryptography | Electrical Engineering and Computer Science | MIT OpenCourseWare* *AICTE prescribed syllabus:* *Industry Mapping:* *Keeping information safe | LinkedIn Learning*	6	1. Using library functions to use RSA, AES, and SHA 256 and show the result of encryption, Hashing etc. 2. Taking apart a digital certificate and show the various components and their significance. Assignment 1: Symmetric Encryption and Decryption - Understand how symmetric key encryption works using tools like Open SSL or Python. Assignment 2: Hashing and Integrity Verification- Learn to generate and verify file hashes using hashing

					algorithms like MD5, SHA-256. Tools: Kali Linux, Cyber Chef
3	Authentication, Authorization and Privilege	Importance of strong Authentication, distinction between authentication and authorization, importance of authorization, access control, Mandatory and Discretionary Access control, role based authorization, privilege and privilege escalation	*International Standards: Computer Systems Security | Electrical Engineering and Computer Science | MIT*	3	Lab on 2 factor authentication, Lab on privilege escalation example Assignment1: Privilege Escalation Lab setup. - Here we setup our own privilege exclamation lab.

			Open Course Ware AICTE prescribed syllabus: Industry Mapping: Verify identity and access privileges | LinkedIn Learning		Assignment 2: Kioptrix lab setup and Box Hacking - Here we can see how can we gain access with a system Assignment 3: Blu box Hacking - Here we see how we gain access to a WIN7 machine by exploiting a well-known vulnerability. Assignment 4: Mr. Robot Box Hacking - Here we see how we gain a access to a machine and how can we gain access. Assignment 5: Linux Privilege Exclaration Here we can see some basic privilege technics of linux Tools: Kali linux, Metasploite, nmap

4	Application Security	Basic application vulnerabilities (Buffer overflow, Integer Overflow, format string vulnerability), Basic mitigations of buffer overflow platform bases, compiler based, secure programming practice Web Client Security, Same Origin Principle, DOM, Java Script Vulnerability, Cookies and Cookie Attributes Secure, http only, Concept of session and session ID, Session hijacking vulnerability, http vs. https and SSL/TLS and version issue Web Server Security XSS, CSRF, SQL Injection, Command Injection concepts, examples of each and	*International Standards Computer Systems Security | Electrical Engineering and Computer Science | MIT Open Course Ware AICTE prescribed syllabus: Industry Mapping Learn to secure applications | LinkedIn Learning*	15	2. Buffer overflow, integer overflow and format string vulnerability testing in vulnerable applications. 2. DVWA based command injection. SQL injection, XSS and CSRF Assignment 1: Burp Suite Setup - Here we can see how we can capture a request or response using burpsuite Assignment 2: Lab setup (Metasploitable 2) Here we setup a web hacking box Assignment 3: Broken authentication - Here we see how to perform a broken authentication vulnerability in a

		mitigation techniques			website Assignment 4: SQL Injection - Here we see how to perform a SQL Injection vulnerability in a website Assignment 5: CSRF - Here we see how to perform a CSRF vulnerability in a website Assignment 6: XSS - Here we see how to perform a XSS Vulnerability in a website Tools: Burpsuite, Webgoat, Nessus, OpenVas

5	**Perimeter protection and Intrusion Detection**	Host Intrusion Detection techniques, what are the indicators to look for and how an SIEM tool can consolidate such indicators into a management console Network Intrusion Detection signature based vs. behavior based, Snort Firewall vs. Intrusion Detection tool, Firewall rules and customization techniques	*International Standards* *Computer Systems Security | Electrical Engineering and Computer Science | MIT OpenCourseWare* *AICTE prescribed syllabus:* *Industry Mapping* *Securing the network | LinkedIn Learning*	6	Students are asked to install Wazuh and monitor a host. Students are asked to install snort and monitor a network on their local network Assignment 1: wireshark - Here we see how network traffic flows Tools: kali linux, Wireshark
6	**Basic Malware Analysis**	Various malware classes and their characteristics Difference between static analysis and dynamic analysis Signature vs. behavioral detection techniques	*International Standards* *Network and Computer Security | Electrical Engineering and Computer Science | MIT*	3	US static analysis tools to find how an executable can be analyzed. Assignment 1: Making a Malware - Here we make a basic malware Assignment 2:

			OpenCourseWare *AICTE prescribed syllabus:* *Industry Mapping: Understanding what malware*		Windows hack using a Malware - Here we hack our own windows machine using a malware Tools: Kali Linux, Metaspolite

7	**Mobile Application Security**	Basic mobile attack surface and the ideas of permissions, and their abuse Execution model of mobile apps in Android (Sandboxing) and communication	Provide intuition on mobile malware and how they work, give example of mobile malware attacks, provide intuition of execution model of Android and demonstrate Mandatory Access Control idea in action, SE Linux being part of Android		Expert Lecture

8	**WLAN Security**	Some common ways WLAN are compromised including weak cipher such as WEP, evil twin attack, unauthorized access point based attacks (rogue WLAN) etc.	Provide students idea about how to look for signs of these rogue WLAN, evil twins, public Wi-Fi etc.	3	Expert Lecture

Textbooks:

1. Cyber Security, Nina Godbole & Sumit Belapure, WILEY
2. Ross J. Anderson, Security Engineering, Third Edition, Wiley, Nov 2020
3.Cyber Crime and its Prevention in Easy Steps, Debtoru Chatterjee, Khanna Publishing House, 2022

Reference Books:

1. Cyber Attacks and Counter-Measures Made Simple, Debtoru Chatterjee, Khanna Publishing House, 2022
2. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws 2nd Edition by D Stuttard and M Pinto
3. Cryptography and Network Security by William Stallings.

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Subject Name: Big Data Analytics

Subject Code: OEEC804A

Credit: 3

Lecture Hours: 36

Pre-requisite: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

Relevant Links:

NPTEL	COURSERA	Linked in

Course Objectives:

1. Understand the Big Data Platform and its Use cases. Provide an overview of Apache Hadoop.
2. Provide HDFS Concepts and Interfacing with HDFS.
3. Understand Map Reduce Jobs. Provide hands on Hodoop Eco System.
4. Apply analytics on Structured, Unstructured Data. Exposure to Data Analytics with R.

Course Outcomes:

Students will be able to

CO1: The students will be able to: Identify Big Data and its Business Implications.

CO2: List the components of Hadoop and Hadoop Eco-System. Access and Process Data on **Distributed** File System.

CO3: Manage Job Execution in Hadoop Environment. Develop Big Data Solutions using Hadoop Eco System.

CO4: Analyze Infosphere BigInsights Big Data Recommendations. Apply Machine Learning Techniques using R.

Detailed syllabus:

Module number	Topic	Sub-topics	Mapping with Industry	Lecture Hours
Module-1	**A closer look at Data**	Understanding Data and Its Evolution, New Data vs. Traditional Data, Paradigm Shift in Data Management	International Academia; https://mitwpu.edu.in/programme/bsc-data-science-and-big-data-analytics Chapter 1 & 2 (Book: Seema Acharya, Wiley 2015)	4
	Introducing Big Data	Big Data: An Overview, The Vs related to Big Data; Sources of Big Data; Common applications of Big Data; Introduction to Big Data technologies – Hadoop, MapReduce, NoSQL.		

Module-2	**Introducing Hadoop**	Overview of Hadoop; Configuring Hadoop cluster; Storing and reading files in HDFS; Fault tolerance and replication; NameNode failure management; HDFS commands; Hadoop distributions.	International Academia; https://web.stanford.edu/class/cs106e/lectureNotes/L13NDatabases.pdf Chapter 3, 4 & 5 (Book: Seema Acharya, Wiley 2015)	16
	Introducing Map Reduce	Basic overview of MapReduce; Processing data with MapReduce; Technical flow of a MapReduce job; Parallelism in MapReduce phases; Optimizing Map phase; What is YARN; Job execution in Hadoop cluster.		
	Introducing NoSQL	Basic introduction to NoSQL; NoSQL databases in the light of CAP Theorem; Types of NoSQL databases : Key-Value Stores, Wide Column Stores or Columnar Stores, Document Stores, Graph Databases; Basic introduction to Cassandra.		
	Introducing Spark and Kafka	Introduction to Spark; Resilient Distributed Datasets (RDD); Spark Libraries; Working with Kafka.		

Module-3	**Other Big Data tools and technologies**	Hive; PIG, Sqoop and Flume; Oozie; Lucene and Solr; Zookeeper; Apache NiFi.	International Academia;	12
	Big Data with R	Basic introduction to R language; Data manipulation; Data exploration; R libraries for dealing with large data sets; Integrating Hadoop with R.	https://uit.stanford.edu/service/techtraining/class/fundamentals-big-data	
	Big Data with Python	Basic introduction to R language; Basic libraries in Python; libraries for dealing with large data sets; Python-MapReduce using Hadoop Streaming.	Chapter 6, & 7 (Book: Seema Acharya, Wiley 2015)	

Module-4	**Big Data Applied**	Big Data and Data Science; Big Data and IoT; Big Data and Recommendation Engines	International Academia; https://chennai.vit.ac.in/computer-science-engineering-chennai/bigdata/	4
	Big Data Strategy	Use cases for Big Data adoption; Data Warehouses vs. Data Lakes; Key questions to ask; Getting ready for a Big Data program		
	Big Data case study			

Text Books:

- Tom White " Hadoop: The Definitive Guide" Third Editon, O'reily Media, 2012.
- Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

References:

• Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

• Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)

• Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.

• Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Subject Name: Optimization Technique

Credit: 3

Lecture Hours: 36

Subject Code: OECEC804B

Pre-requisite: Engineering Mathematics (Calculus, Linear Algebra)

Relevant Links: Study Material Coursera01 NPTEL LinkedIn Learning

Course Objective:

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

1. Understand optimization problem formulation, objectives, and constraints.
2. Learn classical and modern optimization algorithms.
3. Analyze single-variable and multivariable optimization techniques.
4. Solve constrained optimization using direct and indirect methods.
5. Apply evolutionary and swarm-based techniques for real-world engineering problems.

Course Outcome:

At the end of the course, the students will be able to:

1. Formulate fitness/cost functions and define constraints for optimization problems.
2. Implement single-variable optimization and gradient-based methods.
3. Analyze and apply multivariable & multi-objective optimization (Pareto-based methods).
4. Implement bio-inspired algorithms such as GA, PSO, DE, ACO and solve complex problems.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Project Based Learning
1	**Introduction to Optimization Fundamentals**	Optimal problem formulation Design variables, bounds, constraints Objective functions Engineering optimization problem types Overview of optimization algorithms	***International Academia:*** MIT 6.255/15.093 Optimization Methods Stanford EE364A: Convex Optimization IEEE Transactions on Evolutionary Computation ***AICTE-prescribed syllabus:*** https://www.aicte.gov.in/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf	6	**Optimization for Engineering Design – K. Deb —** Chapters 1–2 **Optimization: Theory & Applications – S.S. Rao —** Chapter 1	• Formulate optimization models for engineering design (truss, beam, circuits). • Build a simple cost minimization model for logistics or supply chain. • Solve a real-life scheduling problem (bus scheduling, exam scheduling). • Optimize fuel consumption of a system using mathematical modelling. • Optimize parameters of an electronic filter/circuit manually and via software.

2	**Single-Variable Optimization Algorithms**	Optimality criteria Bracketing methods: exhaustive search, region elimination Interval halving, Fibonacci search Point estimation Successive quadratic estimation Gradient-based methods: Newton-Raphson, Bisection, Secant	**International Standards** : University of Illinois: Numerical Optimization ***AICTE prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf***	8	**Optimization for Engineering Design – K. Deb — Chapters 3–4** **Optimization: Theory & Applications – S.S. Rao — Chapters 2–3**	• Implement Fibonacci Search in Python/Matlab. • Compare speed of Bisection vs Newton-Raphson numerically. • Perform error analysis of different line search algorithms. • Optimize a single-variable cost function (energy → cost).

3	**Multivariable Optimization**	Optimality criteria Unidirectional search Evolutionary optimization Simplex search Hooke–Jeeves method Cauchy (Steepest Descent) Newton's Multivariable Method Multi-objective optimization Pareto optimality	**International Standards** : • MIT OCW: Multi-objective Optimization ***AICTE prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf*** ***Industry mapping:*** mechanical design, antenna optimization	8	**Optimization for Engineering Design – K. Deb -** Multivariable optimization chapters	• Implement Steepest Descent for a 2-variable function. • Solve a constrained mechanical design problem. • Generate a Pareto front using 2 objectives (e.g., weight vs strength). • Apply Simplex search to tune PID controller parameters.

4	**Constrained Optimization Techniques**	Characteristics of constrained problems Direct methods: Complex Method, Cutting Plane Method Indirect methods: Transformation method Penalty method: Exterior & Interior penalty Convex optimization basics	**International Standards** : Stanford Convex Optimization (CVX) ***AICTE prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf***	7	**Optimization for Engineering Design – K. Deb - Penalty methods, constrained algorithms** **Optimization: Theory & Applications – S.S. Rao —** Constrained optimization chapters	• Implement penalty function optimization for a box-constrained problem. • Solve Lagrange multiplier-based engineering optimization. • Optimize cost of a structure with stress/deflection constraints.

			Industry mapping: Structural optimization, finance optimization			
5	**Advanced Optimization Algorithms**	Genetic Algorithm (GA) GA operators, selection methods Simulated annealing Particle Swarm Optimization (PSO) Differential Evolution (DE) Bacterial Foraging Optimization (BFO) Ant Colony Optimization (ACO)	**International Standards** : IEEE Swarm Intelligence ***AICTE prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE%20after%20addedum.pdf*** ***Industry mapping:*** scheduling, routing, control	7	**Optimization for Engineering Design – K. Deb -** Evolutionary Algorithms **Optimization: Theory & Applications – S.S. Rao —** (Multi-objective Optimization)	• Implement GA for function minimization. • Use PSO to optimize parameters of ML algorithms. • Solve Travelling Salesman Problem using ACO. • Compare GA vs PSO vs DE on benchmark functions.

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Subject Name: Sensors & Transducers Lab

Credit: 1

Total Lab Hours: 34

Subject Code: PEEC892A

Course Objective:

1. To demonstrate the theory, construction and operation of different types of resistive, inductive, capacitive, piezoelectric, and special transducers.
2. To offer an overview of the applications of various transducers and the requirements for choosing a transducer for a certain application.
3. To provide insight into the static and dynamic properties of various sensors/instrument designs.
4. To impart knowledge on 8-Chanel Data Acquisition System.
5. To provide students with opportunities to develop basic skills in the design of electronic equipment.

Course Outcome:

After performing the following experiments students will be able to

CO1: Understand the concept of different sensors and their applications in industries.

CO2: Understand the practical approach for designing different technology based sensors.

CO3: To analyse working of different sensors and transducers based equipment used in process industry.

CO4: To design prototype equipment using different sensors and transducers.

List of Experiments:

1. **Measure Liquid Level** in a tank using a capacitive proximity sensor, focusing on its application for automation systems in industries.
2. **Measure Pressure** of liquid in a tank using a piezo-resistive sensor, with applications in feedback control for industrial processes.
3. **Monitor and Control Temperature** using an RTD (Resistance Temperature Detector) to ensure consistent process conditions in industrial environments.
4. **Measure Temperature** using a thermistor, with applications in automation processes for industrial operations.
5. **Use a Thermocouple for Temperature Sensing** to automate switching between two industrial processes.
6. **Detect and Measure Speed** in machinery using an inductive proximity sensor for automation in industrial processes.
7. **Study the Operation of Magnetic Sensors** for their use in automatic switching in conveyor systems and robotic applications.
8. **Test Optical Sensors and Opto-Couplers** for their role in signal isolation and noise reduction in high-speed industrial systems.
9. **Control Object Position** using an LVDT for precise movement in automated assembly lines.

10. **Design and Implement Signal Conditioning Circuits** using Op-Amps to linearize the sensor output for accurate force measurement in process industries.
11. **Set Up an 8-Channel Data Acquisition System** to collect, process, and analyze real-time data for predictive maintenance in industrial setups.
12. **Measure Acceleration** of a moving object using an accelerometer for applications in medical devices and aerospace systems.
13. **Measure Angular Deflection** using a gyroscope to monitor and control motion in medical and aerospace applications.

Learning Resources:

Text Book:

1.Sensor & transducers, D. Patranabis, 2nd edition, PHI

Reference Book:

2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill

4. Link for LinkedIn Courses:

https://www.linkedin.com/learning/iot-foundations-fundamentals/sensors?trk=learning-serp_learning-search-card_search-card&upsellOrderOrigin=sem-ga_campid.11663861480_asid.114329355340_crid.481097052948_kw.linkedin%2Blearning%2Bcourses_d.c_tid.kwd-336730500916_n.g_mt.e_geo.9061848

5. Link for Coursera Courses:

III) https://www.coursera.org/learn/pressure-force-motion-humidity-sensors

IV) https://www.coursera.org/learn/electric-vehicle-sensors

6. Link for Study Material:

https://drive.google.com/drive/folders/1MsvI8flatkyqbeCcM3_PSz7EYQWUPteK?usp=sharing

University of Engineering and Management, Kolkata
Institute of Engineering & Management, Salt Lake
Institute of Engineering & Management, New Town
University of Engineering & Management, Jaipur

Subject Name: Antenna and Propagation Theory Lab

Subject Code: PEEC892B

Credit: 1
Lecture Hours: 39

Pre-requisite: Electromagnetic Waves, Microwave Theory and Techniques.

Coursera link: https://www.coursera.org/learn/microwave-antenna

Linked link: https://www.linkedin.com/learning/introduction-to-telecommunications-standards-networks-and-innovations/antenna-basics-types?resume=false

NPTEL link: https://nptel.ac.in/courses/108101092

Course Outcome (CO):

CO1: Students would be able to understand basic electromagnetic principles and analyze the fundamentals of antenna theory.
CO2: Students would be able to understand antenna arrays and radiation properties of antennas.
CO3: Students would be able to understand the characteristic properties of different types of antennas with their applications and respective radiation mechanism.
CO4: Students would be able to apprehend and analyze the atmospheric and terrestrial effects on radio wave propagation.

Program Specific Outcome (PSO):

PSO1: RF, Microwave & Antenna Engineering Competence: Graduates will be able to analyze, design, and simulate RF, microwave, and antenna systems using modern engineering tools such as MATLAB, CST, and HFSS, and apply electromagnetic principles to real-world communication systems.

PSO2: Communication Systems & Signal Propagation Analysis: Graduates will be able to understand, model, and evaluate various radio wave propagation mechanisms, including ground, sky, and space wave propagation, and assess their impact on wireless communication system performance.

PSO3: Embedded, IoT & Wireless Technology Integration: Graduates will be able to apply knowledge of antennas, wireless networking, and low-power communication protocols to design efficient IoT and embedded communication systems aligned with current industry standards.

Detail syllabus:

Module number	Topic	Sub-Topics
1	Antenna Types	To study various types of antennas.
2		To write a program using MATLAB for radiation pattern of a Simple Dipole Antenna.
3		Experimental Measurement of the Radiation Pattern of a Simple Dipole Antenna.
4		To develop a MATLAB program that generates the radiation pattern of a folded dipole antenna.
5		Measurement of the Radiation Pattern of a Folded Dipole Antenna.
6		To develop a MATLAB program for generating the radiation pattern of a Yagi–Uda antenna.
7		Experimental Measurement of the Radiation Pattern of a Yagi–Uda Antenna.
8		To develop a MATLAB program for generating the radiation pattern of a Loop Antenna.
9		Experimental Measurement of a Loop Antenna Radiation Pattern.
10	Broadside Array of Dipole Antenna	Experimental measurement of the radiation pattern of a broadside array of dipole antenna.

11	**Microstrip Patch Antenna**	**Experimental Characterization of a Patch Antenna Radiation Patterns.**
12		**Design and Simulation of a Microstrip Patch Antenna Using CST/HFSS with the aid of Gen AI.**
13	**Slot Waveguide Antenna**	**Design and Simulation of a Slot Waveguide Antenna Using CST/HFSS with the aid of Gen AI.**
14	**Project work**	**Assignment I and Assignment-II**

University of Engineering and Management, Kolkata
Institute of Engineering & Management, Salt Lake
Institute of Engineering & Management, New Town
University of Engineering & Management, Jaipur

Subject Name: Essential Study for Professionals -VIII
Subject Code: ESP801
Credit: 0.5
Lecture Hours: 48

Module number	Topic	Sub-topics	Mapping with International/National/ State Level Exams	Lecture Hours	Corresponding Assignment
1	**Constitution of India**	**Textbook: BPSC-102** Egyankosh URL for subject matter: 1. Evolution of Indian Constitution (Unit 1 & Unit 3) (https://egyankosh.ac.in/handle/123456789/57865 &	***National Exams:*** ***1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*** ***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/Portal***	10	Assignment: • Trace the evolution of Indian constitution from 1174 to 1947 Discussion: • What are the potential consequences of the CAA for India's social fabric? Debate:

		https://egyankosh.ac.in/handle/123456789/57869) **IGNOU Textbook(BPSC-102**Unit 3) https://egyankosh.ac.in/handle/123456789/57869 **History & Civics (ICSE Class IX Textbook : Sudeshna Sengupta): (Chapter-1): https://books.google.com.na/books?id=XJL5Rk6aHYUC&printsec=copyright&hl=en&pli=1#v=onepage&q&f=false** (Making of Constitution **IGNOU Textbook(BPSC-102,**Unit 1) https://egyankosh.ac.in/handle/123456789/57865 **NCERT Textbook Class XI (India Constitution at Work: Chapter-1) : https://ncert.nic.in/textbook.php?keps2=1-10**	***Management/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22*** ***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)*** ***State Level Exams:*** ***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1*** ***2.* Miscellaneous Services Recruitment Examination (*file:///C:/Users/UEMK/Downloads/2707970_2019.pdf) pg 1*** **Right to Privacy vs. National Security:** Should governments have the right to surveil citizens in the name of national security, even if it infringes upon the right to privacy? ** All the assignments are in line of GS Paper I of UPSC CSE Mains Examination

		History & Civics (ICSE Class IX Textbook : Sudeshna Sengupta): (Chapter-1): **https://books.google.com.na/books?id=XJL5Rk6aHYUC&printsec=copyright&hl=en&pli=1#v=onepage&q&f=false)** 2. Part I: Union and its Territories (**Chapter 5 – Indian Polity – M.Laxmikanth**) 3. Part II: Citizenship (**Chapter 6 – Indian Polity – M.Laxmikanth**) 4. Part III: Fundamental Rights. (Unit 4) **IGNOU Textbook(BPSC-102)** (Unit 4) https://egyankosh.ac.in/handle/123456789/57872			

		NCERT Textbook Class XI (India Constitution at Work: Chapter-2): https://ncert.nic.in/textbook.php?keps2=2-10 **History & Civics (ICSE Class IX Textbook : Sudeshna Sengupta): (Chapter-3):** **https://books.google.com.na/books?id=XJL5Rk6aHYUC&printsec=copyright&hl=en&pli=1#v=onepage&q&f=false** (In brief and Capsule Form)			
2	**History**	**Textbook:** **IGNOU** **BHIC-107 History of India-IV (c. 1206-1550)** **1. The Delhi Sultanate – Consolidation and Expansion** (Theme- II Unit II)	***National Exams:*** ***1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf , pg 20-21)*** ***3. Combined Graduate Level conducted***	12	• Assignment: " Prithviraj Chauhan in Literature and Folklore: Exploring the portrayal of Prithviraj Chauhan in literature." • Discussion: "From Slave Dynasty to Tughlaq Dynasty:

		https://egyankosh.ac.in/handle/123456789/73298 **BHIC-109 History of India-V (c.1550-1605)** **2. The Rise of the Mughal (till Akbar)** (Theme II- Unit 5, Unit 6) https://egyankosh.ac.in/handle/123456789/77551 (In brief and Capsule Form)	***by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22*** ***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf*** ***State Level Exams:*** ***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1*** ***2.* Miscellaneous Services Recruitment Examination (file:///C:/Users/UEMK/Downloads/2707970_2019.pdf), pg 1***		Analyzing Military Tactics and Strategies." • Debate: "Babur's Conquest: Was it Driven by Ambition or Necessity?" ** All the assignments are in line of GS Paper I of UPSC CSE Mains Examination.
3	**Geography**	**Textbook:** **BGGET- 141** Egyankosh URL for subject matter: **IGNOU-Block 1** 1. Political Division of India (Unit 1)	***National Exams:*** ***1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*** ***3. Combined Graduate Level conducted***	12	1. **Assignment:** Comparative Analysis Essay on "Comparative analysis of the political divisions in India and another country of their choice" bringing out how historical, cultural, and geographical factors have influenced the political boundaries in both nations and

		http://egyankosh.ac.in//handle/123456789h/80893 2. Physiographic Division of India in Brief (Unit 2) ttp://egyankosh.ac.in//handle/123456789/80895 (In brief and Capsule Form)	***by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22*** ***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)*** ***State Level Exams:*** ***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1*** ***2.* Miscellaneous Services Recruitment Examination (file:///C:/Users/UEMK/Downloads/2707970_2019.pdf) pg 1***		discuss the implications of these divisions on governance and socio-economic development. 2. **Discussion:** How physiographic divisions have been used (or misused) in different contexts, such as the management of river basins, the planning of infrastructure projects, or the conservation of biodiversity. ** All the assignments are in line of GS Paper I of UPSC CSE Mains Examination.
4	**Economics**	1. Capital and Money Market **(Textbook: S.Y.B.A)** https://www.icsi.edu/media/webmodules/publications/CapitalMarketandSecuritesLaw.pdf 2. Fiscal System of	***National Exams:*** ***1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*** ***3. Combined Graduate Level conducted***	09	1.Capital and Money Market Write a case study on how the RBI used monetary policy to respond to a specific economic crisis (e.g., the 2008 global financial crisis or the COVID-19 pandemic). 2. Fiscal system of India Analyze the relationship between fiscal

		India.(BECC-109, Block-3, Unit-9) http://egyankosh.ac.in//handle/123456789/76561 (In brief and Capsule Form)	***by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22*** ***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)*** ***State Level Exams:*** ***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1*** ***2.* Miscellaneous Services Recruitment Examination (file:///C:/Users/UEMK/Downloads/2707970_2019.pdf) pg 1***		policy and economic growth in India
5	**Current Affairs and Static GK:**	National News, International News, MOU's and agreements, Summits and Conclaves, Obituaries, Awards and Events, Sports, Important Days, Banking and Economic Awareness	***National Exams:*** ***1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*** ***3. RBI Grade B***	5	1. Discussion on National and International affairs 2. Discussion on MOU's and agreements, Summits and Conclaves 3. Discussion on recent Awards and Events, Sports. 4. Discussion on Economic

			(https://rbidocs.rbi.org.in/rdocs/Content/PDFs/DADVTGRB09052023FA65E4FB1C2CF473396B4FD7E5F69CDDE.PDF), pg 22-23 ***4. IBPS Probationary officer(https://www.ibps.in/wp-content/uploads/Detailed-Advt.-CRP-PO-XII.pdf) , Pg 7.*** ***5. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22*** ***6. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)*** ***State Level Exams:*** ***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1*** ***2.* Miscellaneous Services Recruitment Examination (file:///C:/Users/UEMK/Downloads/2707970_2019.pdf), pg 1***		Awareness

Learning Resources:

Reference Books:

1. Current Affairs Magazine of IEM-UEM
2. Lucent GK

Institute of Engineering & Management, Salt Lake
Institute of Engineering & Management, New Town
University of Engineering & Management, Jaipur

Subject Name: Skill Development for Professionals- VIII
Subject Code: SDP881
Credit: 0.5
Lecture Hours: 48

Module number	Topic	Sub- topics	Mapping with International/National/ State Level Exams	Lecture Hours	Corresponding Assignment
1	**Revision and Advanced Problems in Quantitative Aptitude:**	**Textbook:** Quantitative Aptitude for Competitive Examination **Author:** R.S Agarwal **Publishing House:** S. Chand 1. Practice sets of UPSC CSAT-II, IBPS PO,	***National Exams:*** ***1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*** ***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22***	12	PRACTICE SETS OF CORRESPONDING EXAMINATIONS

		CAT, MAT etc. 2. Previous year placement sets.	***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)*** ***State Level Exams:*** ***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1*** ***2.*** **Miscellaneous Services Recruitment Examination** (https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf ***) pg 1***		
2	**Revision and Advanced Problems in Reasoning**	**Textbook:** Verbal and Non-Verbal reasoning **Author:** R.S Agarwal **Publishing House:** S. Chand 1. Practice sets of UPSC CSAT-II, IBPS PO, CAT, MAT etc. 2. Previous year placement sets.	***National Exams:*** ***1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*** ***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22*** ***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-***	12	PRACTICE SETS OF CORRESPONDING EXAMINATIONS

			content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf) ***State Level Exams:*** ***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1*** ***2.*** **Miscellaneous Services Recruitment Examination** (***file:///C:/Users/UEMK/Downloads/2707970_2019.pdf) pg 1***		
3	**Revision and Advanced Questions in Verbal English**	**Textbook:** Objective General English **Author:** R.S Agarwal **Publishing house:** S. Chand 1. Reading Comprehension 2. Essay Writing 3. Practice sets of UPSC CSAT-II, IBPS PO, CAT, MAT etc. 4. Placement question sets from previous	***National Exams:*** ***1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*** ***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22*** ***4. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)***	12	PRACTICE SETS OF CORRESPONDING EXAMINATIONS

		years along with the syllabi for all preceding semesters.	***State Level Exams:*** ***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement, pg 1*** ***2.* Miscellaneous Services Recruitment Examination** (https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf***) pg 1***		
4	**Data Interpretation**	**Textbook:** Quantitative Aptitude for Competitive Examination **Author:** R.S Agarwal **Publishing House:** S. Chand 1. Practice sets of UPSC CSAT-II, IBPS PO, CAT, MAT etc. 2. Previous year placement sets.	***National Exams:*** ***1.UPSC Civil Services Exam (https://upsc.gov.in/sites/default/files/Notif-CSP-23-engl-010223.pdf), pg 25-26*** ***2. UPSC Combined Defence Services (https://upsc.gov.in/sites/default/files/Notif-CDS-I-Exam-2023-Engl-211222.pdf), pg 20-21*** ***3. Combined Graduate Level conducted by SSC (https://ssc.nic.in/SSCFileServer/PortalManagement/UploadedFiles/notice_CGLE_03042023.pdf) pg. 20-22*** ***1. Intelligence Bureau ACIO (https://www.pw.live/exams/wp-content/uploads/2023/11/IB-ACIO-Recruitment-2023-Notification-Emp-News.pdf)*** ***2. RBI Grade B***	12	PRACTICE SETS OF CORRESPONDING EXAMINATIONS

			(https://rbidocs.rbi.org.in/rdocs/Content/PDFs/DADVTGRB09052023FA65E4FB1C2CF473396B4FD7E5F69CDDE.PDF), pg 22-23 ***State Level Exams:*** ***1.Civil Services Executive Exam (WBCS) (https://wbpsc.gov.in/Download?param1=20230225142430_Syllabus.pdf&param2=advertisement), pg 1*** ***2.*** **Miscellaneous Services Recruitment Examination** (https://adda247jobs-wp-assets-prod.adda247.com/jobs/wp-content/uploads/sites/7/2022/11/21142422/2707970_2019.pdf***) pg 1***		