FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABUS

FOR
B.TECH. (ELECTRONICS & COMMUNICATION ENGINEERING)

(Credit Based Evaluation and Grading System)

(SEMESTER: I-VIII)

Batch from Year 2020 to Year 2024

GURU NANAK DEV UNIVERSITY AMRITSAR

Note:

(ii) Subject to change in the syllabi at any time.
Please visit University website time to time.

B.Tech. (Electronics and Communication Engineering) **1st Semester (CBEGS)**
(Syllabus for the Batch from Year 2020 to Year 2024)

SCHEME

SEMESTER –I

S. No.	Course Code	Course Title	L	T	P	Credits
1.	CYL197	Engineering Chemistry	3	0	1	4
2.	MTL101	Mathematics-I	3	1	0	4
3.	ECL119	Basic Electrical &Electronics Engineering	4	0	1	5
4.	CSL126	Fundamentals of IT & Programming using Python	2	1	1	4
5.	ENL101	Communicative English-I	2	0	0	2
6.		Elective-I	2	0	0	2
7.	MEP101	Workshop Practices	0	0	2	2
8.	SOA 101	Drug Abuse: Problem, Management and Prevention (Compulsory ID)	2	0	0	2
List of Electives–I:						
1.	PBL121	Punjabi (Compulsory)**OR**	2	0	0	2
2.	PBL122*	**ਮੁੱਢਲੀ ਪੰਜਾਬੀ OR**	2	0	0	
3.	HSL101*	Punjab History & Culture (1450-1716)	2	0	0	
		Total Credits:	**18**	**2**	**5**	**25**

Note:
***Special Paper in lieu of Punjabi Compulsory, for those students who are not domicile of Punjab.**

B.Tech. (Electronics and Communication Engineering) **1st Semester (CBEGS)**
(Syllabus for the Batch from Year 2020 to Year 2024)

SEMESTER –II

S. No.	Course Code	Course Title	L	T	P	Credits
1.	CEL120	Engineering Mechanics	3	1	0	4
2.	MEL120	Engineering Graphics & Drafting	2	0	2	4
3	MTL102	Mathematics-II	3	1	0	4
4.	PHL183	Physics	3	1	1	5
5.	MEL110	Introduction to Engg. Materials	3	0	0	3
6.		Elective-II	2	0	0	2
7.	PSL 055	Human Rights and Constitutional Duties (Compulsory ID)	2	0	0	2
List of Electives–II:						
1.	PBL131	Punjabi (Compulsory)**OR**	2	0	0	2
2.	PBL132*	ਮੁੱਢਲੀ ਪੰਜਾਬੀ	2	0	0	
3.	HSL102*	Punjab History & Culture (1717-1947) **OR**	2	0	0	
		Total Credits:	**18**	**3**	**3**	**24**

Note:

*** Special Paper in lieu of Punjabi Compulsory, For those students who are not domicile of Punjab**

Course Name	**:**	**Engineering Chemistry**
Course Code	**:**	**CYL-197**
Credits (L-T-P)	**:**	**4 (3-0-1)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the water quality requirement for human consumption, different treatment process for municipal water treatment, application of glass, ceramics, composites, magnetic materials, Role of refractories for synthesis of high performance materials. Polymer, rubber and silicone material uses in daily life. Introduction to electrochemistry. Application of CNT and graphene in electronics industry.

Total No. of Lectures –45

	Lecture wise breakup	**Number of lectures**
	SECTION - A	
1	**Water hardness:** Common impurities of water, Hardness: Introduction, EDTA method for determination of hardness, degree of hardness. Numerical based on hardness and EDTA method.	4
2	**Water hardness related problems:** Boiler troubles, their causes, disadvantages and prevention: Formation of solids (scale and sludge), carry over (priming and foaming), corrosion and caustic embrittlement.	2
3	**Water treatment techniques**: Introduction, water purification techniques, steps involved in purification of water, sedimentation, coagulation, filtration and sterilization, chlorination.	3
4	**Softening of water:** Lime-Soda method, Zeolite method, Deionization/Demin-eralization methods. Numerical problems based on Lime-Soda and Zeolite softening methods.	3

SECTION - B		
5	**Glasses, Ceramics, Composites** Glassy state, glass formers and modifiers, types of glasses, manufacturing, applications. Ceramic structures, types of ceramics and their properties. Composites; types, properties and applications.	6
6	**Magnetic Materials:** Introduction, types of magnetic material, hard and soft ferrites, magnetic properties and applications.	3
7	**Refractories:** Definition, classification, properties, requisites of good refractory, manufacturing of refractory, silica and fire clay refractory and their uses. Seger's (Pyrometric) Cone Test and RUL Test.	3
SECTION - C		
8	**Polymers:** Introduction, classification and constituents of polymers, polymer structure and properties, glass transition temperature (T_g), melting point (T_m), structure-property relations (general), synthesis, properties and application of commercial polymers (Bakelite, Polyethylene, Polypropylene, Polystyrene, Polycarbonate, Polytetrafluoroethylene, Polyester and Nylon)	6
9	**Polymer processing methods**: Introduction, compounding, moulding (Injection, Compression, Blow film and Extrusion). Application of polymers such as contact lenses, bulletproof vest, etc.	3
10	**Rubber:** Introduction, natural rubber, vulcanization, different types of rubber, synthesis of rubbers viz. Buna-S, Buna-N, Buty1 and neoprene rubbers, properties and application.	3
SECTION - D		
12	**Silicone based compounds:** Introduction, properties, preparation of silicones, cross-linked silicones, silicon fluids or oils, silicon elastomers and their applications.	2
13	**Electrochemistry:** Introduction, Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, Arrhenius theory of ionization, specific conductance, molar conductance, Faraday's Law of electrolysis, Chemical cells, distinguish between electrolytic and galvanic cell, reversible and irreversible cells with examples. Standard electrode (reduction) potential of half-cells. Applications of electrochemistry in daily life.	4
14	**Nanomaterial:** Introduction, properties, general methods of preparation. Applications of fullerenes, CNTs and graphene.	3

List of Practicals:

1. Determination of total hardness of Water.
2. Determination of temporary and permanent hardness of water.
3. To determine the strength of sodium carbonate in given sample of washing soda.
4. To determine the strength of sodium carbonate and sodium hydroxide in caustic soda solution.
5. To determine the strength of acetic acid in vinegar
6. Find the strength of KMnO4 solution with oxalic acid
7. Find the strength of KMnO4 solution with Mohr's salt.
8. To determine the number of water molecules in Mohr's salt by titration method.
9. Determination of relative viscosity of a given liquid with respect to water by viscometer.
10. Determination of surface tension of a given liquid by drop number method by stalagmometer.
11. To determine the strength of strong and weak acid conductometry
12. To determine the critical micelle concentration of a soap (sodium laurate) by surface tension measurements.

Course Outcomes:	
1	Develop new methods to produce soft water for industrial use and potable water at low cost.
2	Replace metals with polymer in different application areas.
3	Develop low cost and new methods for synthesis of Nano materials.
4	Apply their knowledge for development of new application of electrochemistry.
5	Demonstrate the knowledge of polymer materials for advance engineering applications.

Suggested / ReferenceBooks:	
1	Engineering Chemistry by P.C. Jain & Monica Jain Dhanpat Rai Publishers, NewDelhi.2014.
2	Physical Chemistry by A. Peter and J.de. Paula 10th Edition Oxford University Press, 2014.
3	Inorganic Polymers by P.B. Saxena, Discovery Publishing House, 2007.
4	Ferrite materials by V.R.K. Murthy & B. Viswanathan, SpringerVerlag, Berlin, 1990
5	Advanced practical physical chemistry by J.B Yadav by Krishna's educational publishers.

E-learning resource: https://nptel.ac.in/courses.php

Course Name	**:**	**Mathematics-I**
Course Code	**:**	**MTL-101**
Credits (L-T-P)	**:**	**4 (3-1-0)**
Total Marks	**:**	**100**
Mid Semester	**:**	**20% weightage**
End Semester	**:**	**80% weightage**

Instructions for the Paper Setters:-
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

The aim of the course is to introduce the important topics of mathematics to future engineers which they would find useful in their respective engineering branches. This course would act as foundation for the students with basic as well as advanced concepts for familiarizing them with the use of mathematics to the real life and problems associated with their respective disciplines.

Total No. of Lectures – 44

	Lecture wise breakup	**Number of Lecture**
	SECTION - A	
1	**Matrices:** Introduction to matrices, Inverse and rank of a matrix, rank-nullity theorem; Symmetric, skew-symmetric and orthogonal matrices, Hermitian and skew-Hermitian matrices, Unitary matrix, Determinants; System of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem.	10
	SECTION - B	
2	**Infinite Series:** Convergence and divergence of infinite series, Geometric series test, Positive term series, p-series test, [Comparison test, D' Alembert's ratio test, Cauchy's root test, Integral test, Raabe's test, Logarithmic test, Gauss's test] (without proofs), Alternating series and Leibnitz's rule, Power series, Radius and interval of convergence.	10

SECTION - C		
3	**Differential Calculus:** Partial Derivatives, Euler's theorem on homogeneous functions, Maclaurin's and Taylor's expansions of single and two variables, Maxima and minima of functions of several variables, Lagrangian method of multipliers, Multiple integrals and their use in obtaining surface areas and volumes of solids.	12
SECTION – D		
4	**Vector Calculus:** Scalar and Vector point functions, Differentiation of vectors, Gradient of a scalar field, Divergence and Curl of a vector field, Line integral of a vector field, Surface integral of vector field, Volume integral of a scalar field, Green's theorem, stokes theorem, Gauss divergence theorem (without proofs) and their applications.	12

Course Outcomes:	
1	Students will be able to calculate rank of matrix, characteristic equation & characteristic roots & use the applicability of Caylay Hamilton Theorem to find inverse of matrix which is very important in many engineering application.
2	It will equipped the students in determining whether the given function can be approximated with the power series.
3	Students will learn the various applications of mathematics using vector calculus techniques.

Suggested / Reference Books:	
1	Kreyszig: Engineering Mathematics, Wiley Eastern Ltd.
2	B.S. Grewal: Higher Engineering Mathematics, Khanna Publisher, New Delhi.
3	Louis A. Pipes: Applied Mathematics for Engineers and Physicists, McGraw Hill Book

Course Name	**:**	**Basic Electrical & Electronics Engineering**
Course Code	**:**	**ECL-119**
Credits (L-T-P)	**:**	**5 (4-0-1)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
This course is aimed to introduce important initial understanding of electrical and electronics engineering to the 1st year students, this will act as the foundation for the advanced electronics courses. The aim of this course is to familiarize the students to the basics of electricity, electrical machines and the basics of electronic devices. so that they can use this knowledge in relevant applications.

Total No. of Lectures –48

Lecture wise breakup		**Number of Lectures**
SECTION – A		
1	**Electricity and power supply**: Features of the power supply system, power station, transmission, distribution lines, difference between AC and DC, voltage, current and resistance, concept of electromagnetic induction and production of alternating e.m.f - single phase and 3 phase, 3-phase star and delta connections, voltage and current relations. **Electrical Machinery:** Transformer, its working principle, types of transformers and their applications, performance losses, efficiency and voltage regulation, open circuit and short circuit tests on transformer, auto transformers.	12

SECTION – B		
2	**Circuit Analysis**: A brief review of DC and single phase AC circuits. , Star-delta load transformation, concept of balanced and unbalanced three phase circuits, measurement of power and power factor in three phase balanced circuits. **Semiconductors:** Introduction to semiconductors, Intrinsic Semiconductor, n-type and p-type semiconductors, Effect of Doping, Fermi levels, Charge flow in semiconductors.	12
SECTION – C		
3	**PN junction diode**: Theory of PN junction diode, depletion layer, barrier potential, Volt-Ampere Characteristics, Current Components, Storage Capacitance and transition capacitance, Junction diode switching times, Zener diode, LED, Photodiode, Varactor diode, Schottky diode **Bipolar Junction Transistors**: Junction Transistor, Current components, transistor as an amplifier, CB, CE and CC configurations and characteristics.	12
SECTION – D		
4	**Fundamentals of DC & AC Motors:** Working principle, construction, types & characteristics of DC motor, Working principle of Single-Phase & Three-Phase Induction motor, Three phase synchronous motor. **Control and Protection**: Control mechanism, principle and applications of protection devices: Fuses, MCB, LCB, relays. Need& types of earthing and grounding, Cables, Construction of LT & HT cables.	12

Course Outcomes: After study of this subject the student will become	
1	Familiar with the electricity production, distribution and the use of control/protection devices.
2	Able to understand the working and applications of electrical machines.
3	Able to understand the basics of semiconductor devices and their applications.
4	Familiar to the concept of rectification and filtration circuits.
5	Able to analyze the basic DC and AC circuits and to solve related circuit problems.

Suggested / ReferenceBooks:	
1	Principles of Electrical Engineering by Gupta BR; S. Chand and Company, New Delhi.
2	Electrical Technology by Hughes Edward; The English Language Book Society and Longmans. Group Limited, London
3	Electrical Machines by Bhattacharya SK; Tata McGraw Hill, Delhi.
4	Basic Electrical Engineering by T.K. Naggarkar& Ms. Sakhija Seventh Edition 2008, Oxford University Press.
5	Electronic Devices and Circuit Theory, Boylestad R.L. VIII Edition, Pearson Education, 2008.
6	Electronic Fundamentals & Application, J.D. Ryder, PHI, 2006.
7	Experiments in Electrical Engineering by Bhatnagar US; Asia Publishing House, Bombay.

PRACTICAL:

1. Study of VI characteristics of PN junction
2. Study of Half wave, full wave & Bridge rectifiers.
3. Study of simple capacitive, T & II filters.
4. Study of zener as a voltage regulator.
5. Study of transistor characteristics in CC, CB and CE configuration
6. To study the performance characteristic of clipper circuit
7. To study the performance characteristic of clamper circuit

Course Name	**:**	**Fundamentals of information technology and programming using python**
Course Code	**:**	**CSL 126**
Credits (L-T-P)	**:**	**4 (2-1-1)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the basics of computer as well as programming. The students are able to write programs. This course introduces computer programming using the Python programming language. Emphasis is placed on common algorithms and programming principles utilizing the standard library with Python.

Total No. of Lectures –

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	Block diagram of Computer, Associated peripherals, Memories – RAM, ROM, Secondary Storage Devices, Classification of Computers and Languages, Introduction to Compilers, Interpreter and Assemblers, Introduction of various operating system with their file system.	
	SECTION - B	
2	Algorithm and Flowchart, Introduction to Python and Setting up the Python development environment, Basic syntax, interactive shell, editing, saving, and running a script, Concept of data types, Random number, Real numbers, immutable variables, Python console Input / Output. Arithmetic operators and expressions, Conditions, Comparison operators, Logical Operators, Is and In operators, Control statements: if-else, Nested If-Else, Loops (for, while)	
	SECTION - C	
3	Built in function and modules in python, user defined functions, passing parameters, arguments and return values; formal vs actual arguments, Recursion, lists, Common List operations	

SECTION - D		
4	String Handling, Unicode strings, Strings Manipulation:-compare strings, concatenation of strings, Slicing strings in python, converting strings to numbers and vice versa. Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).	
Course Outcomes:		
1	Implement a given algorithm as a computer program in python language with the understanding of hardware components and memory utilization.	
2	Able to use standard programming constructs: repetition, selection, functions, composition, modules and different data types	
3	Adapt and combine standard algorithms to solve a given problem (includes numerical as well as non-numerical algorithms) and to debug the program written in python language	

Suggested / Reference Books:	
1	Computers Today by Sanders.
2	Fundamentals of Computers TTTI Publication.
3	Learning Python by Mark Lutz, 5th edition
4	Python cookbook, by David Beazley , 3rd Edition
5	Python Essential Reference, by David Beazley , 4th edition
6	Python in a Nutshell, by Alex Mortelli, 2nd Edition.
7	Python programming: An Introduction to computer science, by John Zelle, 2nd Edition.

ENL-101: COMMUNICATIVE ENGLISH –I

Credits: 2-0-0
Total Marks-100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Objective: To introduce students to the skills and strategies of reading and writing by identifying organizational patterns, spotting classification systems and understanding associations between ideas. This course will prepare students to read a variety of texts and also to communicate more effectively through writing. The course will also pay special attention to vocabulary building.

Prescribed Text books:

- *The Written Word* by Vandana R. Singh, Oxford University Press, New Delhi.
- *Making Connections: A Strategic Approach to Academic Reading* by Kenneth J. Pakenham, Second Edition.

SECTION–A

"Word List", "Correct Usage of Commonly used words and Phrases" from the chapter "Vocabulary" given in ***The Written Word*** by Vandana R. Singh.

SECTION–B

Letter- writing as prescribed in ***The Written Word*** by Vandana R. Singh.
Report writing as prescribed in ***The Written Word*** by Vandana R. Singh.

SECTION–C

Section 1 from ***Making Connections: A Strategic Approach to Academic Reading*** by Kenneth J. Pakenham, Second Edition.

SECTION–D

Section 2 from ***Making Connections: A Strategic Approach to Academic Reading*** by Kenneth J. Pakenham, Second Edition.

CourseName	**:**	**Workshop Practices**
CourseCode	**:**	**MEP-101**
Credits (L-T-P)	**:**	**2 (0-0-2)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the

1. Understand applications of hand tools and power tools.
2. Understand the operations of machine tools.
3. Select the appropriate tools required for specific operation.
4. 4. Comprehend the safety measures required to be taken while using the tools.

Total No. of Practicals – 48

	Lecture wise breakup	**Number of Practicals**
	SECTION - A	
1	Carpentry Shop: (a) Study of tools & operations and carpentry joints. (b) Simple exercise using jackplane. (c) To prepare half-lap corner joint, mortise &tennon joints. (d) Simple exercise on wood working lathe.	6
2	Fitting (Bench Working) Shop: (a) Study of tools & operations (b) Simple exercises involving fitting work. (c) Make perfect male-female joint. (d) Simple exercises involving drilling / tapping / dieing.	6

SECTION - B		
3	Black Smithy Shop: (a) Study of tools & operations (b) Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering& swaging.	6
4	Welding Shop: (a) Study of tools & operations of Gas welding & Arc welding. (b) Simple butt and Lap welded joints. (c) Oxy-acetylene flame cutting.	6
SECTION - C		
5	Sheet-metal Shop: (a) Study of tools & operations. (b) Making Funnel complete with soldering. (c) Fabrication of tool-box, tray, electric panel box etc.	6
6	Machine Shop: (a) Study of Single point cutting tool, machine tools and operations. (b) Plane turning. (c) Step turning. (d) Taper turning. (e) Threading.	6
SECTION - D		
7	Foundry Shop: (a) Study of tools & operations (b) Pattern making. (c) Mould making with the use of a core. (d) Casting	6
8	Electrical and Electronics Shop: (a) Study of tools & operations	6

Course Outcomes:	
1	To acquire skills in basic engineering practice, measuring skills and practical skills in the trades.
2	To provides the knowledge of job materials in various shops.
3	To identify the hand tools and instruments.
4	To provides the knowledge of core technical subjects for making and working ofany type of project.
5	Understand modern manufacturing operations, including their capabilities,limitations, and how to design economically.
6	Gain insight into how designers influence manufacturing schedule and cost, andcost of different components.
7	Learn how to analyze products and be able to improve their manufacturability andmake the cost effectively.

Suggested / Reference Books:	
1	Lab Manual to be provided by Department of Mechanical Engineering
2	Work shop technology by Hajra and Chaudhary
3	Work shop technology by Chapmen

PBL 121 : ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ - ।

ਸਮਾਂ : 3 ਘੰਟੇ **ਕਰੈਡਿਟ : 2**
ਕੁਲ ਅੰਕ : 50

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ।ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਸੈਕਸ਼ਨ-ਏ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
ਕਵਿਤਾ ਭਾਗ : 1-4 ਕਵੀ
(ਕਵੀ ਦਾ ਜੀਵਨ, ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ)

II. ਗੁਰਮੁਖੀ ਔਰਥੋਗਰਾਫੀ ਦੀ ਜੁਗਤ (ਪੈਂਤੀ, ਮੁਹਾਰਨੀ, ਬਿੰਦੀ, ਟਿੱਪੀ ਤੇ ਅੱਧਕ); ਵਿਸ਼ਰਾਮ ਚਿੰਨ੍ਹ, ਸ਼ਬਦ ਜੋੜ (ਸ਼ੁਧ-ਅਸ਼ੁਧ)

ਸੈਕਸ਼ਨ-ਬੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
ਕਵਿਤਾ ਭਾਗ : 5-8 ਕਵੀ
(ਕਵੀ ਦਾ ਜੀਵਨ, ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ)

II. ਲੇਖ ਰਚਨਾ (ਜੀਵਨੀ-ਪਰਕ, ਸਮਾਜਕ ਅਤੇ ਚਲੰਤ ਵਿਸ਼ਿਆਂ ਉੱਤੇ) : 10 ਲੇਖ ਲਿਖਵਾਉਣੇ
(ਕਲਾਸ ਵਿਚ ਅਤੇ ਘਰ ਲਈ ਅਭਿਆਸ)

ਸੈਕਸ਼ਨ-ਸੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
ਕਹਾਣੀ ਭਾਗ : 1-4 ਕਹਾਣੀਆਂ
(ਕਹਾਣੀ ਦਾ ਵਿਸ਼ਾ-ਵਸਤੂ, ਸਾਰ, ਕਹਾਣੀ-ਕਲਾ)

II. ਸ਼ੁੱਧ, ਅਸ਼ੁੱਧ : ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦਾਂ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ
(15 ਪੈਰ੍ਹਿਆਂ ਦੇ ਸ਼ੁੱਧ ਅਸ਼ੁੱਧ ਅਭਿਆਸ ਕਰਵਾਉਣੇ)

ਸੈਕਸ਼ਨ-ਡੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
ਕਹਾਣੀ ਭਾਗ : 5-8 ਕਹਾਣੀਆਂ
(ਕਹਾਣੀ ਦਾ ਵਿਸ਼ਾ-ਵਸਤੂ, ਸਾਰ, ਕਹਾਣੀ-ਕਲਾ)

II. ਅਖ਼ਬਾਰੀ ਇਸ਼ਤਿਹਾਰ : ਨਿੱਜੀ, ਦਫ਼ਤਰੀ ਤੇ ਸਮਾਜਕ ਗਤੀਵਿਧੀਆਂ ਨਾਲ ਸੰਬੰਧਤ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ

1. ਰਾਜਿੰਦਰਪਾਲ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਕਵਿਤਾ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
2. ਬ੍ਰਹਮਜਗਦੀਸ਼ ਸਿੰਘ, **ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਾਵਿ ਸਿਧਾਂਤ, ਇਤਿਹਾਸ ਅਤੇ ਪ੍ਰਵਿਰਤੀਆਂ**, ਵਾਰਿਸ ਸ਼ਾਹ ਫਾਉਂਡੇਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
3. ਬਲਦੇਵ ਸਿੰਘ ਧਾਲੀਵਾਲ, **ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
4. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, **ਪੰਜਾਬੀ ਕਹਾਣੀ ਦਾ ਸਫ਼ਰ ਤੇ ਸ਼ਾਸਤ੍ਰ ਭਾਗ-**, ਸਿੰਘ ਬ੍ਰਦਰਜ਼, ਅੰਮ੍ਰਿਤਸਰ।
5. ਹਰਕੀਰਤ ਸਿੰਘ ਤੇ ਗਿਆਨੀ ਲਾਲ ਸਿੰਘ, **ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਣ**, ਪੰਜਾਬ ਯੂਨੀਵਰਸਿਟੀ, ਚੰਡੀਗੜ੍ਹ।
6. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।
7. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ
8. **ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਬੋਧ**, ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਅੰਮ੍ਰਿਤਸਰ।

PBL-122 : ਮੁੱਢਲੀ ਪੰਜਾਬੀ
(In lieu of Compulsory Punjabi)

ਸਮਾਂ : 3 ਘੰਟੇ **ਕਰੈਡਿਟ : 2**
ਕੁਲ ਅੰਕ : 50

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਸੈਕਸ਼ਨ-ਏ

ਪੈਂਤੀ ਅੱਖਰੀ : ਅੱਖਰ ਕ੍ਰਮ, ਮਾਤ੍ਰਾਵਾਂ
(ਮੁੱਢਲੀ ਜਾਣ-ਪਛਾਣ)
ਲਗਾਖਰ (ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ) : ਪਛਾਣ ਤੇ ਵਰਤੋਂ

ਸੈਕਸ਼ਨ-ਬੀ

ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਮੁੱਢਲੀ ਜਾਣ-ਪਛਾਣ
ਸਾਧਾਰਨ ਸ਼ਬਦ, ਸੰਯੁਕਤ ਸ਼ਬਦ, ਮਿਸ਼ਰਤ ਸ਼ਬਦ
ਮੂਲ ਸ਼ਬਦ, ਅਗੇਤਰ ਅਤੇ ਪਿਛੇਤਰ

ਸੈਕਸ਼ਨ-ਸੀ

ਸ਼ੁੱਧ ਅਸ਼ੁੱਧ : ਦਿੱਤੇ ਪੈਰ੍ਹੇ ਵਿਚੋਂ ਅਸ਼ੁੱਧ ਸ਼ਬਦਾਂ ਨੂੰ ਸ਼ੁੱਧ ਕਰਨਾ
ਸਮਾਨਾਰਥਕ ਤੇ ਵਿਰੋਧਾਰਥਕ ਸ਼ਬਦ

ਸੈਕਸ਼ਨ-ਡੀ

ਹਫ਼ਤੇ ਦੇ ਸੱਤ ਦਿਨਾਂ ਦੇ ਨਾਂ, ਬਾਰ੍ਹਾਂ ਮਹੀਨਿਆਂ ਦੇ ਨਾਂ, ਰੁੱਤਾਂ ਦੇ ਨਾਂ,
ਇਕ ਤੋਂ ਸੌ ਤੱਕ ਗਿਣਤੀ ਸ਼ਬਦਾਂ ਵਿਚ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ

1. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਅਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।
2. **ਮੁੱਢਲੀ ਪੰਜਾਬੀ**, ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
3. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।

PUNJAB HISTORY & CULTURE
HSL-101 : HISTORY AND CULTURE OF THE PUNJAB (1450-1716)
(Special paper in lieu of Punjabi Compulsory)

Credits: 2-0-0
Marks : 50

Mid Semester Examination: 20% Weightage
End Semester Examination: 80% Weightage

Instructions for the Paper Setters

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

1. Land and the People.
2. Bhakti Movement

SECTION-B

3. Life and Teaching of Guru Nanak Dev.
4. Contribution of Guru Angad Dev, Guru Arjun Dev ,Guru Amar Das and Guru Ram Das.

SECTION-C

5. Guru Hargobind.
6. Martyrdom of Guru Teg Bahadur

SECTION-D

7. Guru Gobind Singh and the Khalsa.
8. Banda Singh Bahadur: Conquests and Execution.

Suggested Reading

1. Kirpal Singh(ed.), *History and Culture of the Punjab, Part-ii, Punjabi University,* Patiala. 1990.
2. Fauja Singh (ed.), *History of Punjab, Vol, III Punjabi University, Patiala, 1987.*
3. J.S. Grewal, *The Sikhs of the Punjab, Cup, Cambridge, 1991.*
4. Khushwant Singh, *A History of the Sikhs,* Vol. I, OUP, New Delhi, 1990

Course Name	**:**	**Engineering Mechanics**
Course Code	**:**	**CEL-120**
Credits (L-T-P)	**:**	**4 (3-1-0)**
Total Marks	**:**	**100**
Mid Semester	**:**	**20% weightage**
End Semester	**:**	**80% weightage**

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

- To understand distributed force systems, centroid/ centre of gravity and method of finding centroids of composite figures and bodies.
- To understand moment of inertia and method of finding moment of inertia of areas and bodies.
- To understand dynamics of a particle.
- To understand the kinetics of rigid bodies and simple problems.

Total No. of Lectures –

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	Introduction: Force system, dimensions and units in mechanics, laws of mechanics, vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application. Equilibrium: Static and dynamic equilibrium, static in determinacy, general equations of equilibrium, Varingnon's theorem, Lami's theorem, equilibrium of bodies under a force system, Problems.	
	SECTION - B	
2	Truss and Frames: Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems. Centroid, Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems.	

SECTION - C		
3	Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects. Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problems.	
SECTION - D		
4	Particle Dynamics: Energy methods and momentum methods, Newton's laws, work energy equation for a system of particles, linear and angular momentum equations, projectile motion, problem. Shear Force and Bending Moment Diagram for statically determinant beams Classification of beams, types of loads, shear force and bending moment calculation and their graphical presentation, point of inflection, problem.	

Course Outcomes:	
1	Basic understanding of laws and principles of mechanics.
2	Ability to analyse and solve simple problems of mechanics.
3	An understanding of assumptions and limitations of approaches used.

Suggested / Reference Books:	
1	Engineering Mechanics – Irving H. Shames, PHI Publication.
2	Engineering Mechanics – U.C. Jindal, Galgotia Publication.
3	Mechanics–Berkeley Physics Course, Vol–I (Second Edition): C. Kittel, W.D. Knight, M.A. Ruderman, C.A. Helmholtz and R.J. Moyer–Tata McGraw Hill Publishing Company Ltd., New Delhi.

Course Name	**:**	**Engineering Graphics & Drafting**
Course Code	**:**	**MEL-120**
Credits (L-T-P)	**:**	**4 (2-0-2)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the

1. Increase ability to communicate with people
2. Learn to sketch and take field dimensions.
3. Learn to take data and transform it into graphic drawings.
4. Learn basic CAD skills.
5. Learn basic engineering drawing formats
6. Prepare the student for future Engineering positions

Total No. of Lectures – 48

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	Introduction: Instruments used, Lettering, Types of Lines used, Scales, Types of Projections in use, Dimensioning of Figures, etc.; Orthographic Projections of Points, Lines & Lamina **Lab Work:** Introduction to AutoCAD, Practice of 2D commands, Exercises related to the theory contents of Unit-I	12
	SECTION - B	
2	Projection of Solids: Section of Solids & its Projections; Interpenetration of Solids & Curve of Interpenetration; Development of Surfaces. **Lab Work:** Familiarity with 3D commands, Exercises related to the theory contents of Unit-II	12
	SECTION - C	
3	Isometric Drawing & Isometric Projection **Lab Work:** Lab Exercises related to the theory contents of Unit-III	12
	SECTION - D	

4	Free-Hand sketching of Engineering Components, Advance 3D Commands: Solving Problems using AutoCAD. **Lab Work:** Lab Exercises related to the theory contents of Unit-IV	12

Course Outcomes:	
1	Student's ability to hand letter will improve.
2	Student's ability to perform basic sketching techniques will improve.
3	Students will be able to draw orthographic projections and sections.
4	Student's ability to use architectural and engineering scales will increase.
5	Student's ability to produce engineered drawings will improve.
6	Student's ability to convert sketches to engineered drawings will increase.
7	Students will become familiar with office practice and standards.
8	Students will become familiar with two and three dimensional drawings.
9	Students will develop good communication skills and team work.

Suggested / Reference Books:	
1	Engineering Drawing, N. D. Bhatt
2	Engineering Graphics with AutoCAD, James D. Bethune
3	Engineering Drawing & Graphics, K. Venugopal
4	Engineering Drawing PS Gill
5	Engineering Drawing, M. B. Shah & B. C. Rana

Course Name	**:**	**Mathematics-II**
Course Code	**:**	**MTL-102**
Credits (L-T-P)	**:**	**4 (3-1-0)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	
End Semester Examination	**:**	

Instructions for the Paper Setters:-

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
The aim of the course is to enlighten the students with engineering mathematics which they would need to implement in their respective engineering branches. This course would prepare the students for implementation of these concepts in future applications and help them trouble shoot the problems associated with their respective disciplines.

Total No. of Lectures – 45

Lecture wise breakup		**Number of Lectures**
SECTION - A		
1	**Fourier Series:** Euler's formula, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even periodic functions, Expansion of odd and even periodic functions, Half-range series	10
SECTION - B		
2	**Ordinary Differential Equations :** Exact equations, Equations reducible to exact equations, Linear differential equations with constant co-efficients, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficients (Cauchy's and Legendre's linear equations).	12
SECTION - C		
3	**Complex Analysis:** De Moivre's theorem with applications, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Cauchy's integral theorem, Cauchy's integral formula (without proofs), Taylor series and Laurent series (without proofs) Residues and Residue theorem.	10

SECTION - D		
4	**Integral Transforms:** Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Fourier transforms, Finite Fourier Sine and Cosine Transforms, modulation theorem, shifting properties, Convolution theorem.	13

Course Outcomes:	
1	The students will be able to classify differential equations according to certain features.
2	The tool of Fourier series and Laplace Transforms for learning advanced Engineering Mathematics.
3	The students will learn the mathematical tools needed in evaluating complex analysis and their usage.

Suggested / Reference Books:	
1	Kreyszig: Engineering Mathematics, Wiley Eastern Ltd.
2	B.S. Grewal: Higher Engineering Mathematics, Khanna Publisher, New Delhi.
3	Louis A. Pipes: Applied Mathematics for Engineers and Physicists, McGraw Hill Book Company.

Course Name	**:**	**Physics**
Course Code	**:**	**PHL-183**
Credits (L-T-P)	**:**	**5 (3-1-1)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

- To make the students aware about Electromagnetic wave fundamentals.
- To make students aware about quantum physics phenomena.

Total No. of Lectures – 48

Lecture wise breakup		**Number of Lectures**
SECTION – A		
1	Electric and magnetic fields in a medium, Susceptibility and Conductivity, Maxwell's equations, Boundary conditions; EM wave equation, Plane wave solutions.	12

SECTION – B		
2	Polarization of the EM waves, Pointing vector and intensity of the EM wave; Wave packet, Phase and Group velocities; Reflection and refraction of EM waves at a dielectric interface; Brewster angle; Total internal reflection at a dielectric interface; EM waves in a conducting medium and plasma.	12
SECTION – C		
3	Wave-particle duality, de-Broglie waves; Quantum mechanical operators; Schroedinger equation, Wave function, Statistical interpretation, Superposition Principle, Continuity equation for probability density; Stationary states, Bound states.	12
SECTION - D		
4	Free-particle solution, 1-D infinite potential well, Expectation values and uncertainty relations; 1-D finite potential well, Quantum mechanical tunneling and alpha- decay, Kronig-Penny model and emergence of bands	12

Course Outcomes:	
1	This will enable the students to learn physical concepts associated with electromagnetic radiation and devices.
2	Student will understand quantum mechanical aspects of physics.

Suggested / Reference Books:	
1	Concepts of Modern Physics. Arthur Beiser, (Tata McGraw-Hill, Sixth Edition 2003).
2	Lasers & Nonlinear optics. B.B. Laud (New Delhi, India: Wiley Eastern 1991).

Course Name	**:**	**Introduction to Engineering Materials**
Course Code	**:**	**MEL-110**
Credits (L-T-P)	**:**	**3 (3-0-0)**
Total Marks	**:**	**100**
Mid Semester	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the:

1. To review physics and chemistry in the context of materials science & engineering.
2. To describe the different types of bonding in solids, and the physical outcomes of these differences.
3. Give an introduction to metals, ceramics, polymers, and electronic materials in the context of a molecular level understanding of bonding.
4. Give an introduction to the relation between processing, structure, and physical properties.
5. Give the beginning student an appreciation of recent developments in materials science & engineering within the framework of this class.
6. Give the beginning student practice in basic expository technical writing.

Total No. of Lectures – 47

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	Introduction**:** Historical perspective, scope of materials science and engineering. Atomic structure and interatomic bonding. Lattices, basic idea of symmetry.	11
	SECTION - B	
2	Lattice structure: Bravais lattices, unit cells, crystal structures, crystal planes and directions, co-ordination number. Single crystals, polycrystalline, non-crystalline, nano-crystalline materials. Imperfections in solids: point defects, line defects, surface defects.	12
	SECTION - C	
3	Solid solutions: phases, phase diagrams. Diffusion phenomenon, phase transformations. Strengthening mechanisms.	12

SECTION - D		
4	Classification of materials: properties of materials. Structure, properties and applications of different metals and alloys, ceramics, composites and polymers.	12

Course Outcomes:	
1	Given a type of material, be able to qualitatively describe the bonding scheme and its general physical properties, as well as possible applications.
2	Given a type of bond, be able to describe its physical origin, as well as strength.
3	Be able to qualitatively derive a material's Young's modulus from a potential energy curve.
4	Given the structure of a metal, be able to describe resultant elastic properties in terms of its 1D and 2D defects.
5	Be able to do simple diffusion problems.

Suggested / Reference Books:	
1	Materials Science and Engineering by W.D. Callister Jr. (John Wiley & Sons Inc., Eighth Edition).
2	Materials Science and Engineering: A First Course by V. Raghvan (Prentice-Hall of India Pvt. Ltd.).

PBL 131 : ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ–II
(Ability Enhancement Compulsory Course)

ਸਮਾਂ : 3 ਘੰਟੇ ਕਰੈਡਿਟ : 2
ਕੁਲ ਅੰਕ : 50

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਸੈਕਸ਼ਨ–ਏ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
1–4 ਨਿਬੰਧ
(ਨਿਬੰਧ ਦਾ ਸਾਰ, ਵਾਰਤਕ ਕਲਾ ਅਤੇ ਸ਼ੈਲੀ)

II. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਧਾਤੂ/ਮੂਲ, ਵਧੇਤਰ (ਅਗੇਤਰ, ਪਿਛੇਤਰ, ਵਿਉਂਤਪਤ ਅਤੇ ਰੁਪਾਂਤਰੀ), ਸਮਾਸ।

ਸੈਕਸ਼ਨ–ਬੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
5–8 ਨਿਬੰਧ
(ਨਿਬੰਧ ਦਾ ਸਾਰ, ਵਾਰਤਕ ਕਲਾ ਅਤੇ ਸ਼ੈਲੀ)

II. ਪੈਰ੍ਹਾ ਰਚਨਾ : ਕਲਾਸ ਵਿਚ 10 ਵਿਸ਼ਿਆਂ (ਸਭਿਆਚਾਰ, ਧਾਰਮਕ ਅਤੇ ਰਾਜਨੀਤਕ) 'ਤੇ ਪੈਰ੍ਹਾ ਰਚਨਾ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ।

ਸੈਕਸ਼ਨ–ਸੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
1–4 ਰੇਖਾ ਚਿਤਰ
(ਨਾਇਕ ਬਿੰਬ, ਕਲਾਤਮਕ ਪੱਖ)

II. ਮੁਹਾਵਰੇ ਤੇ ਅਖਾਣ (ਅਖਾਣ ਤੇ ਮੁਹਾਵਰਾ ਕੋਸ਼ ਵਿਚ) 200 ਮੁਹਾਵਰਿਆਂ ਅਤੇ 100 ਅਖਾਣਾਂ ਨੂੰ ਵਾਕਾਂ ਵਿਚ ਵਰਤਣ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ (ਕਲਾਸ ਵਿਚ ਤੇ ਘਰ ਲਈ)।

ਸੈਕਸ਼ਨ–ਡੀ

I. **ਸਰਵੋਤਮ ਪੰਜਾਬੀ ਸਾਹਿਤ** (ਸੰਪਾ. ਡਾ. ਰਮਿੰਦਰ ਕੌਰ, ਡਾ. ਮੇਘਾ ਸਲਵਾਨ)
5–8 ਰੇਖਾ ਚਿਤਰ
(ਨਾਇਕ ਬਿੰਬ, ਕਲਾਤਮਕ ਪੱਖ)

II. ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ, ਸੰਬੰਧਕ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ

1. ਸਤਿੰਦਰ ਸਿੰਘ, **ਪੰਜਾਬੀ ਵਾਰਤਕ ਦਾ ਇਤਿਹਾਸ**, ਪੰਜਾਬੀ ਅਕਾਦਮੀ, ਦਿੱਲੀ।
2. ਪ੍ਰੋ. ਪਿਆਰਾ ਸਿੰਘ, **ਪੰਜਾਬੀ ਵਾਰਤਕ : ਸਿਧਾਂਤ ਇਤਿਹਾਸ ਪ੍ਰਵਿਰਤੀਆਂ**, ਨਿਊ ਬੁੱਕ ਕੰਪਨੀ, ਜਲੰਧਰ।
3. ਇੰਦਰਪ੍ਰੀਤ ਸਿੰਘ ਧਾਮੀ, **ਪੰਜਾਬੀ ਰੇਖਾ ਚਿਤਰ : ਰੂਪ ਤੇ ਪ੍ਰਕਾਰਜ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
4. ਬਲਬੀਰ ਸਿੰਘ ਦਿਲ, **ਪੰਜਾਬੀ ਨਿਬੰਧ : ਸਰੂਪ, ਸਿੱਧਾਂਤ ਅਤੇ ਵਿਕਾਸ**, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
5. ਹਰਕੀਰਤ ਸਿੰਘ ਤੇ ਗਿਆਨੀ ਲਾਲ ਸਿੰਘ, **ਕਾਲਜ ਪੰਜਾਬੀ ਵਿਆਕਰਣ**, ਪੰਜਾਬ ਯੂਨੀਵਰਸਿਟੀ, ਚੰਡੀਗੜ੍ਹ।
6. ਡਾ. ਅਮਰ ਕੋਮਲ (ਸੰਪਾ.), **ਚੋਣਵੇਂ ਪੰਜਾਬੀ ਨਿਬੰਧ** (ਭੂਮਿਕਾ), ਨੈਸ਼ਨਲ ਬੁੱਕ ਟਰੱਸਟ, ਇੰਡੀਆ।
7. ਅਬਨਾਸ਼ ਕੌਰ, **ਪੰਜਾਬੀ ਰੇਖਾ ਚਿੱਤਰ**, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ।
8. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
9. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।

PBL-132 : ਮੁੱਢਲੀ ਪੰਜਾਬੀ
(In lieu of Compulsory Punjabi)

ਸਮਾਂ : 3 ਘੰਟੇ ਕਰੈਡਿਟ : 2
ਕੁਲ ਅੰਕ : 50

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

ਅੰਕ-ਵੰਡ ਅਤੇ ਪਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

1. ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਚਾਰ ਭਾਗ ਹੋਣਗੇ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ।
2. ਵਿਦਿਆਰਥੀ ਨੇ ਕੁੱਲ ਪੰਜ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਹਨ। ਹਰ ਭਾਗ ਵਿਚੋਂ ਇਕ ਪ੍ਰਸ਼ਨ ਲਾਜ਼ਮੀ ਹੈ। ਪੰਜਵਾਂ ਪ੍ਰਸ਼ਨ ਕਿਸੇ ਵੀ ਭਾਗ ਵਿਚੋਂ ਕੀਤਾ ਜਾ ਸਕਦਾ ਹੈ।
3. ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ ਅੰਕ ਹਨ।
4. ਪੇਪਰ ਸੈੱਟ ਕਰਨ ਵਾਲਾ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਸੈਕਸ਼ਨ-ਏ

ਸ਼ਬਦ ਸ਼੍ਰੇਣੀਆਂ : ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ
(ਨਾਂਵ, ਪੜਨਾਂਵ, ਵਿਸ਼ੇਸ਼ਣ, ਕਿਰਿਆ, ਕਿਰਿਆ ਵਿਸ਼ੇਸ਼ਣ)

ਸੈਕਸ਼ਨ-ਬੀ

ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ : ਬਾਜ਼ਾਰ, ਵਪਾਰ, ਰਿਸ਼ਤੇ-ਨਾਤੇ, ਖੇਤੀ ਅਤੇ ਹੋਰ ਧੰਦਿਆਂ ਨਾਲ ਸੰਬੰਧਤ

ਸੈਕਸ਼ਨ-ਸੀ

ਪੰਜਾਬੀ ਵਾਕ-ਬਣਤਰ
ਸਾਧਾਰਨ ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)
ਸੰਯੁਕਤ ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)
ਮਿਸ਼ਰਤ ਵਾਕ (ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ)

ਸੈਕਸ਼ਨ-ਡੀ

ਪੈਰ੍ਹਾ ਰਚਨਾ
ਸੰਖੇਪ ਰਚਨਾ

ਸਹਾਇਕ ਪੁਸਤਕਾਂ

1. ਬੂਟਾ ਸਿੰਘ ਬਰਾੜ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਸਿਧਾਂਤ ਅਤੇ ਵਿਹਾਰ**, ਚੇਤਨਾ ਪ੍ਰਕਾਸ਼ਨ, ਲੁਧਿਆਣਾ।
2. **ਮੁੱਢਲੀ ਪੰਜਾਬੀ**, ਕਸਤੂਰੀ ਲਾਲ ਐਂਡ ਸੰਨਜ਼, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
3. ਮਿੰਨੀ ਸਲਵਾਨ, **ਪੰਜਾਬੀ ਵਿਆਕਰਨ : ਮੁੱਢਲੇ ਸੰਕਲਪ**, ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।

PUNJAB HISTORY & CULTURE
HSL-102 : HISTORY AND CULTURE OF THE PUNJAB (1717-1947)
(Special paper in lieu of Punjabi Compulsory)

Credits: 2-0-0
Marks : 50
Mid Semester Examination: 20% Weightage
End Semester Examination: 80% Weightage

Instructions for the Paper Setters

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

1. Sikh Struggle for Sovereignty.
2. Ranjit Singh : Conquests, Administration and the Anglo-Sikh Relations.

SECTION-B

3. Anglo-Sikh Wars and the Annexation.
4. The Punjab under the British: New Administration, Education and social Change.

SECTION-C

5. Economic Changes: Agricultural
6. Socio-Religious Reform Movements.

SECTION-D

7. Role of Punjab in the Freedom Struggle.
8. Fairs and Festivals.

Suggested Reading

1. Kirpal Singh (ed.), *History and Culture of the Punjab,* Part-II, Punjabi University, Patiala, 1990.
2. Fauja Singh (ed.), *History of Punjab*, Vol, III, Punjabi University, Patiala, 1987.
3. J.S. Grewal, *The Sikhs of the Punjab, Cup, Cambridge, 1991.*
4. Khushwant Singh, *A History of the Sikhs*, Vol. I, OUP, New Delhi, 1990

SEMESTER – III

S. No.	Course Code	Course Title	L	T	P	Credits
1.	MTL–201	Mathematics – III	3	1	0	4
2.	ECL–211	Digital Electronics	3	1	1	5
3	ECL-212	Analysis & Synthesis of Networks	3	1	1	5
4.	ECL-217	Analog Devices & Circuits	3	1	1	5
5.	ECL-232	Programming in C and Data Structures	3	1	0	4
6.	ESL–220	Environmental Studies (Compulsory)	2	0	0	2
7.	ECP–215	Lab PSPICE	0	0	2	2
8.	ECE–216	Summer Training**	– S/US –			
		Total Credits:	**17**	**5**	**5**	**27**

**** The student should undergo summer training at the end of 2nd Semester. The result will be satisfactory (S) or unsatisfactory (US).**

SEMESTER – IV

S. No.	Course Code	Course Title	L	T	P	Credits
1.	CSL-333	Design and Analysis of Algorithms	3	1	0	4
2.	ECL-214	Analog Integrated Circuits	3	1	1	5
3	ECL–221	Electromagnetic Field Theory	3	1	0	4
4.	ECL–222	Communication Signals and Systems	3	1	0	4
5.	ECL-224	Fiber Optics	3	1	1	5
6.		Elective – III	3	0	1	4
7.	ECP–226*	Electronic Design & Implementation Lab.	0	0	2	2
Total Credits			18	5	5	28
List of Elective III						
	ECL–261	Linear Control System	3	0	1	4
	ECL–262	Electrical & Electronic Measurements	3	0	1	

Note:

1. ***The students are expected to design at least five electronic applications.**
2. **The students of B.Tech. (ECE) 4th Semester are required to undergo Industrial Training four to six weeks after their major examination of 4th Semester in any Industry / Institute of repute. The viva voce will be held along with the viva voce of 5th Semester.**

Course Code	**:**	**MTL-201**
Credits (L-T-P)	**:**	**4 (3-1-0)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
The aim of this course is to take lead from the earlier mathematics courses offered to students. The course will discuss all the important aspects of higher mathematics for their implementation in numerous modern applications.

Total No. of Lectures –

Lecture wise breakup		**Number of Lectures**
SECTION - A		
1	**Partial Differential Equations**: Formation and solutions of partial differential equations, Lagrange's linear equation of the first order, Non-linear equations, Charpit's method, Homogeneous linear equations with constant co-efficients, Non-homogeneous linear equations, Method of separation of variables, Solution of wave equations, Heat flow equations, Laplace's equations and transmission line equations and their applications to engineering problems.	10
SECTION - B		
2	**Integral Transforms:** Dirac-delta Function, Heaviside's Unit Function, Application of Laplace transform to differential equations, IVP and BVP; Applications of Fourier Transform to ODE and PDE, Z- Transforms, Hankel Transforms and its applications	12
SECTION - C		
3	**Fundamental concept of Probability:** Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and Bayes theorem.	10

SECTION - D		
4	**Probability distributions:** Introduction to discrete and continuous Random variables, probability functions, probability density function, cumulative distribution function and their properties, two dimensional random variables, joint distribution of several random variables, cumulative marginal and conditional distribution functions, Expected value. Bernoulli Trials, Binomial Distribution, Poisson and Normal Distribution, Expected value and variance of continuous and discrete random variables	12

Course Outcomes:	
1	To deal with functions of several variables that are essential in most branches of engineering.
2	The students will learn the mathematical tools needed in using applications of Laplace and Fourier Transforms.
3	The students will learn the essential tool of probability distributions in a comprehensive manner.

Suggested / Reference Books:	
1	Kreyszig: Engineering Mathematics, Wiley Eastern Ltd.
2	B.S. Grewal: Higher Engineering Mathematics, Khanna Publisher, New Delhi.
3	Louis A. Pipes: Applied Mathematics for Engineers and Physicists, McGraw Hill Book Company.

Course Name	**:**	**Digital Electronics**
Course Code	**:**	**ECL-211**
Credits	**:**	**5**
LTP	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

1. To make students aware of various number system schemes in digital electronics.
2. To make students aware of combinational and sequential circuits and their designs for use in analog as well as in digital communication circuits.
3. To make students capable of understanding the Logic families and memory storage technologies being used in the latest circuits.

Total No. of Lectures –36

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
	Number System and Binary Code: Introduction, Binary, Octal and hexadecimal number system. Signed and unsigned number, binary operations–Addition, Subtraction. Multiplication and division. Subtractions using 1's and 2's compliment; ASCII code. Excess 3 codes and Gray code. **Minimization of logic function**: OR, AND, NOT, NOR, NAND, Ex–OR gates, Basic theorem of Boolean Algebra sum of products and product of sums canonical form. Minimization using theorems, minimization using K–map and Q–M method.	10

	SECTION – B	
	Combinational Logic Circuits: Introduction, Combinational circuit design, multiplexer, demultiplexer, encoders, decoders, half &full adders, half &full substracters and code converters, parity checker, BCD display drive, magnitude comparators. **Sequential Circuits**: Introduction, flip flop, SR. JK, D, T. Edge triggered and clocked flip–flop, Registers. Types of Registers, circuit diagram, timing wave form and operations, counter, counter design with state equation state diagram.	10
	SECTION – C	
	D/A and A/D Converters: Introduction, Weighted register D/A converter, binary ladder D/A converter, steady state accuracy test. D/A accuracy and resolution, parallel A/D converter Counter type A/D converter, Successive approximation A/D converter, Single and dual slope A./D converter, A/D accuracy and resolution.	8
	SECTION - D	
	Semiconductor Memories: Introduction, Memory organization, Classification and characteristics of memories. Sequential memories, ROMs, RAM memories, Content addressable memories, programmable logic arrays, and charged–coupled device memory. **Logic Families:** DCTL, TTL, ECL, CMOS and its various types, Comparison of logic families.	8

Course Outcomes:	
	At the end of this course students will demonstrate the ability to: 1.Solve Boolean Expressions using minimization techniques. 2.Design and implement the combinational circuits using mapping method. 3.Design and implement the sequential circuits depending upon the excitation states. 4.Implement the various ADC/DAC converters.

Suggested / Reference Books:		
1	Digital Principle and Applications:	Malvino and Leach (TMH)
2	Modern Digital Electronics :	R.P. Jain (TMH)2008.
3	Digital Design:	Morris Mano 5th Edition
4	Fundamentals of Digital Circuits:	A. Anand Kumar (PHI) 3rd Edition, 2014
5	An Engg. Approach to Digital Design :	Fletcher (PRI)

PRACTICALS:

1. To verify truth tables of Basic Gates and Universal Gates.
2. Design and verify truth tables of formation of Basic Gates from Universal Gates.
3. To design and verify truth tables of half adder and full adder circuits.
4. To design and verify truth tables of half-sub tractor and full subtractor circuits.
5. To design and verify truth tables of Encoder and Decoder circuits.
6. Design of Multiplexer and De-Multiplexer Circuits.
7. To design and verify truth table of S-R and D Flip –Flop using NOR/NAND gates.
8. To design and verify truth table of J-K Flip-Flop using NOR/ NAND gates.
9. Designing and Implementation of Synchronous counter.
10. Designing and implementation of Asynchronous Counters.
11. Design and implementation of code convertors.

Course Name	**:**	**Analysis and Synthesis of Networks**
Course Code	**:**	**ECL-212**
Credits	**:**	**5**
LTP	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the

- Analysis of electrical network using different simplification theorems and Laplace Transform
- Synthesis of an electrical network for a given impedance/ admittance function

Total No. of Lectures –44

	Lecture wise breakup	Number of Lectures
	SECTION - A	
1	Circuit Concepts and Theorems: Circuit elements, independent and dependent sources, Mesh & Nodal Analysis, Supermesh and Supernodal analysis, source transformation and duality, Network Theorems: Superposition, Thevenin, Norton, Maximum power Transfer, Tellegen, Reciprocity theorem, Millman and compensation theorem	12
	SECTION - B	
2	Signal Waveforms and Time Domain Analysis: Singularity functions, step, ramp, impulse and doublet function with Laplace transform, shifting functions, Applications of Laplace transform in electrical circuits, Time and Frequency Domain Analysis: Representation of basic circuits in terms of generalized frequency, transient & steady response, DC and sinusoidal response of RL, RC and RLC circuits, Time domain behaviors from poles and zeros	10
	SECTION - C	
3	Filters Synthesis: Classification of filters, characteristic impedance and propagation constant of pure reactive network, ladder network, T–section, Pi–section, design of constant–K, m–derived filters, terminating half section, composite filters	10

SECTION - D		
4	Network Synthesis: Two port parameters, Z parameters, Y parameters, ABCD parameters, h parameters, effect of location of poles and zeros on stability, driving and transfer functions, Hurwitz polynomial, positive real function, network synthesis techniques for 2–terminal network by Foster and Causer's forms.	12

Course Outcomes: After the completion of course, the student will be able to	
1	Identify different types of input signals
2	Analyze the circuit using Network simplification theorems
3	Analyze different networks in time and frequency domain
4	Design different filters and evaluate two-port network parameters
5	Synthesize of one port networks

Suggested / Reference Books:	
1	Circuit and Network Analysis & Synthesis by R. Sudhakar, McGraw-Hill Education.
2	Network Analysis and Synthesis by Ravish R. Singh, McGraw-Hill Education.
3	Network and Systems by D. R. Choudhury, New Age International Publishers.

Practicals

1. Verification of Kirchhoff's Laws, Superposition Theorem, Thevenin Theorem, Norton Theorem, Maximum Power Transfer Theorem and Reciprocity Theorem.
2. Study the transfer characteristics of different filters
3. Design of k and m derived filters
4. Verification of network theorems using PSpice
5. Designing of filters using PSpice

Course Name	**:**	**Analog Devices & Circuits**
Course Code	**:**	**ECL-217**
Credits	**:**	**5**
L TP	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the operation of various important electronic devices and have the knowledge of electronic circuits using these devices. The course contents are designed to cover basic solid state devices and their applications in various electronic circuits and systems.

Total No. of Lectures – 48

	Topic	Number of Lectures
	SECTION – A	
1	**Diode Applications:** Rectifiers- half wave, full wave and Bridge, Filters- L, C, L-Section, π-Filter, Clippers and Clampers.	
2	**Bipolar Junction Transistors:** Transistor at low frequency, Transistor hybrid model, H–parameters, conversion formulas, analysis using h–parameters, Transistor at high frequency and its hybrid (pi) CE model.	12

	SECTION-B	
3. **4.**	**Transistor Biasing and Stabilization:** Operating point, Bias stability, various biasing circuits, stabilization against variation in Ico, VBE and beta, Bias compensation, Thermister and Sensistor compensation, Thermal Runaway. **Field Effect Transistors:** The JFET, JFET parameters, Drain and mutual characteristics, MOSFET- Enhancement type and depletion type, FET as a VVR.	12
	SECTION-C	
5. **6.**	**Feedback Amplifiers:** Feedback concept, Types of Feedback Amplifiers, Effect of negative feedback on transfer gain, input and output resistance, bandwidth, stability, distortion and frequency Response. **Multistage Amplifiers:** Types of Multistage amplifiers like RC, LC, Transformer coupled, Direct coupled amplifiers, their frequency response curves.	12
	SECTION-D	
7.	**Power Amplifier:** Classification of Power amplifiers, analysis of class Class A direct coupled with resistive load, Transformer coupled with resistive load, Class B, C and AB amplifiers, harmonic distortion in amplifiers. push pull amplifier, operation of class-B push-pull amplifier, crossover distortion, complementary-symmetry amplifier.	12

Course Outcomes:	
1	To gain knowledge regarding the various electronics devices such as Diode, BJT, FET, MOSFET, CMOS etc..
2	To know the working principle and their applications.
3	To know the biasing conditions and stabilization techniques for the operating point.
4	To get an insight about the concept of feedback in amplifiers
5	To learn the use of multistage amplifiers in various communication applications.
6	To acquire knowledge about various types of power amplifiers and their application in a particular area

Suggested / Reference Books:	
1	Electronic Devices and Circuit Theory, Boylestad R.L. VIII Edition, Pearson Education, 2008.
2	Integrated Electronics, Millman, J and Halkiias, C.C, TMH, 2007.
3	Electronic Fundamentals & Application, J.D. Ryder, PHI, 2006.
4	Microelectronic Circuits, Sedra& Smith, V Edition, Oxford University Press, 2007
5	Electronic Devices and Circuits by J.J. Cathey, Schaum's Outline Series, TMH, IInd Edition, 2004.
6.	Electronic Devices and Circuits, J.B. Gupta, S.K.Kataria and Sons, 2014

PRACTICAL:

1. Study of an emitter follower circuit.
2. Determination of h–parameters of a transistor.
3. Design of transistor biasing circuits.
4. To study the performance characteristics of phase shift oscillator and to determine the frequency of oscillation.
5. To study the performance characteristics of Hartley / Colpitts oscillator and to determine the frequency of oscillation
6. Study of frequency response of CE–BJT amplifier.
7. Study of frequency response of CS–FET amplifier.
8. Study of frequency response of RC coupled amplifier.
9. Study of Class A/B Transformer coupled power amplifier.
10. Study of Class B Complementary symmetry amplifier.
11. Study of positive and negative feedback in amplifiers

Course Name	**:**	**PROGRAMMING IN C AND DATA STRUCTURES**
Course Code	**:**	**ECL-232**
Credits	**:**	**4**
LTP	**:**	**3-1-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

The students after undergoing the course should be able to :

1. To Understand basic concepts of C language and Solve technical problems by using it
2. To Understand and explain fundamentals of data structures
3. To Write the algorithms used in data structures using programming language C

Total No. of Lectures –36

	Lecture wise breakup	Number of Lectures
	SECTION - A	
	C Language: Data types, operators, expressions, input, output and string functions, control structures for, while, if-else, case looping structure. Arrays	9
	SECTION – B	
	Functions, Structures and Unions, Pointers, Files. Storage Classes, Standard C libraries, Macro's, Advance preprocessor statements, Dynamic memory allocation.	9
	SECTION – C	
	Data Structures Preliminaries - Various Data structures, common operations on data structures. Arrays- insertion, deletion, traversal, searching- Linear search and binary search, sorting, insertion sort, selection sort, and merging. **Stacks-** Introduction, implementation of stack using arrays, Polish notation, Quick sort.	9

	SECTION - D	
	Queues- Introduction, implementation of queue using arrays, deques. **Linked List**- representation of linked list in memory, operations on linked list- creation, traversal, search, insertion and deletion. **Trees** - terminology, binary tree, binary search tree - traversal, search, insertion and deletion.	9

Course Outcomes:	
	At the end of this course, students will have the ability to : 1. Students should be able to solve problems using C and develop approach towards analyzing and evaluating commonly used algorithms of data structures. 2. Understand basic concepts of data structures such as arrays, stacks, linked lists, tree, etc. 3. Students will be able to perform different programming tasks in different programming languages by having basic understanding of data structures.

Suggested / Reference Books:	
1	Seymour Lipschutz : Theory and Problems of Data Structures, Schaum's Outline Series
2	Aho A. V. J. E. Hopcroft, J.D. Ullman; Data Structures and Algorithms, Addison–Wesley, 1983.
3	Baase, S Computer Algorithms; Introduction to Design and Analysis, Addison – Wesley,1978.
4	Berztiss, A. T.: Data Structures, Theory and practice: 2nd ed., Academic Press, 1977.
5	Collins, W.J. Data Structures, An Object–Oriented Approach, Addison – Wesley, 1992.
6.	Goodman, S.E., S.T. Hedetniemi: Introduction to the Design and Analysis of Algorithms, McGraw Hill, 1977.
7.	Horowitz, E.S. Sahni: Algorithms: Design and Analysis, Computer Science Press, 1977.
8.	Kunth, D.E. The Art of Computer Programming. Vols. 1–3, Addison – Wesley, 1973.
9.	Kurse, R.L. Data Structures and Program Design, 2nd Ed., Prentice Hall, 1987.
10.	Lorin, H.: Sorting and Sort Systems, Addison – Wesley, 1975.
11.	Standish, T.A.: Data Structure Techniques, Addison – Wesley, 1980.
12.	Tremblay, J.P., P.G. Sorenson: An Introduction to Data Structures with Applications, McGraw Hill, 1976.
13.	Wirth, N.: Algorithms + Data Structures = Programs, Prentice Hall, 1976.

Course Name	**:**	**PSPICE**
Course Code	**:**	**ECP-215**
Credits	**:**	**2**
LTP	**:**	**0-0-2**

1. Introduction to PSPICE, MATLAB and SIMULINK.
2. Verification of network theorem
3. Resonant Circuits: R–L–C series and parallel circuits
4. Amplifiers: Using BJT and OP–amps
5. Oscillators circuits: Using BJT and OP–amps
6. Frequency Response of CE Amplifier
7. Design and Verification of Class–A Power Amplifier
8. Frequency response of Integrated circuits
9. Stability of feedback amplifiers

Course Name	**:**	**SUMMER TRAINING**
Course Code	**:**	**ECE-216**
Credits	**:**	**-**
LTP	**:**	**-S/US-**

Students would showcase their projects and jobs performed in machine shops and Electronics Laboratory during their summer training and appear for the viva voce examination for the same.

Course Name	**:**	DESIGN AND ANALYSIS OF ALGORITHM
Course Code	**:**	CSL–333
Credits	**:**	**4**
L TP	**:**	**3-1-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

Introduction: Concept of Algorithm, Algorithm Specification, Performance Analysis (Time and space complexities), Asymptotic Notations.

Divide and conquer: General Method, Binary Search, Finding the Maximum and Minimum, Quick Sort, Selection.

SECTION-B

Greedy Method: General Method, Knapsack Problem, Minimum Cost Spanning Trees (Prim's Algorithm, Kruskal's Algorithm) and Single-Source Shortest Path.

Dynamic Programming: General Method, Multistage Graphs, All Pairs Shortest Paths, Single - Source Shortest Paths, Optimal Binary Search Tress, 0/1 Knapsack and Travelling Salesman Problem.

SECTION-C

Backtracking: General Method, 8-Queens Problem, Graph Coloring, Hamiltonian Cycles and Subset-Sum Problem.

Branch-and-Bound: General Method, Travelling Salesman Problem.

SECTION-D

Hard Problems: Basic Concepts, Nondeterministic Algorithms, Classes NP – Hard and NP – Complete, NP–Hard Graph Problems (CNDP, DHC, TSP and AOG).

Approximation Algorithms: Introduction, Absolute Approximation (Planer Graph Coloring and NP–Hard Absolute Approximations), ε –Approximations (Scheduling Independent Tasks and Bin Packing).

References:

1. Aho , Hopcroft and Ullman “The Design and Analysis of Computer Algorithms”, 2003.
2. Horowitz, S. Sahni, Sanguthevar Rajasekaran “Fundamentals of Computer Algorithms”, 2003.
3. R.G.Droomy, “How to Solve it by Computer”, Third Printing, 1989.
4. K. Mehlhorn, “Data Structures and Algorithms”, Vols. 1 and 2, Springer Verlag, 1984.
5. Purdom, Jr. and C. A. Brown, The Analysis of Algorithms, Holt Rinechart and Winston, 1985.
6. D. E. Kunth, The Art of Computer Programming, Vols.I and 3, 1968, 1975.

Course Name	**:**	**ANALOG INTEGRATED CIRCUITS**
Course Code	**:**	**ECL–214**
Credits	**:**	**5**
L TP	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

1. To introduce the basic building blocks of linear integrated circuits.
2. To teach electrical parameters and applications of operational amplifier integrated circuit.
3. To introduce the use and applications of integrated circuits like 741, 351, 555, 78XX, 79XX, 566, MC 1408 etc.
4. To introduce the concepts of waveform generation and introduce some special function ICs.

Total No. of Lectures – 42

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	**Differential and Cascode Amplifiers:** Introduction to differential amplifier and its configurations, Dual Input Balanced output, Dual Input Unbalanced Output, Single Input Balanced output, Single Input Unbalanced Output.	2
2	Swamping Resistors, Constant Current Bias, Current Mirror	3
3	**Introduction to Op–Amp:** Overview and pin description of 741 C op-amp. Operational Amplifier: Block diagram, characteristics and linear applications	4
4	Interpretation of data sheets: characteristics, important electrical parameters and their values.	3

SECTION - B		
5	**Concept of Feedback:** Introduction and Block diagram representation of negative feedback configurations: Voltage Series and Voltage Shunt feedback and derivation of important electrical parameters. Positive feedback in Oscillators: Phase Shift and Wien Bridge Oscillators.	5
6	**Filters:** Introduction and Design of Low Pass, High Pass, Band Pass, Band Reject, Butterworth and all pass filters.	3
SECTION - C		
7	**Operational Amplifier Applications:** Peaking amplifier, scaling and averaging amplifier, V to I and I to V converter, log and antilog amplifier.	5
8	Instrumentation and Isolation amplifier, Analog multiplier, Integrator, Differentiator, Sample and Hold circuit, Schmitt Trigger	6
9	Function Generator, Spectrum Analyzer, Precision rectifiers, Clippers and clampers, Peak detectors.	5
SECTION - D		
10	**Specialized IC Applications:** Introduction, block diagram and applications of 555 timer as Monostable, Astable and Bistable Multivibrator.	3
11	Phased Locked Loops: Operating principles, characteristics and applications, Voltage Regulators: Fixed, Adjustable and Switching.	3

PRACTICALS -: LIST OF PRACTICALS

Section A

1. **Design a circuit using op-Amp 741 to find input offset current and bias current characteristics.**
2. **Design a circuit using op-Amp 741 to find input offset voltage and output offset voltage characteristics.**
3. **Design a circuit using op-Amp 741 to find its slew rate.**

Section B

4. **Design a circuit using op-Amp 741 to find its input and output resistance characteristics.**
5. **Design a wein bridge oscillator using operational amplifier IC 741. (ME-655)**

Section C

6. **To study the conversion of input voltage into proportional current irrespective of load for inverting & non-inverting modes. (ETB-169)**
7. **To study the principles of voltage controlled current source.**
8. **To study conversion of current to proportional voltage in inverting and non-inverting modes. (ETB-170)**
9. **To study the conversion of analogue D.C. voltage into proportional frequency with 50% duty cycle having linear relationship, using integrator, Schmitt trigger and master slave j.k. flip flop in toggle mode. (ETB-171)**
10. **To study schmitt's trigger circuit for the desired values of upper threshold voltage and lower threshold value and also study the effect of feedback on threshold voltages. (ETB-181)**

Section D

11. **Design an astable multi vibrator using 555 timer for generation of rectangular and square wave forms.**
12. **Design voltage to time convertor and voltage to frequency convertor using 555 timer.**
13. **Design power supplies with voltage regulations of +5 V and -5 V using 7805 and 7905 rectifier IC's.**

Course Outcomes:	
1	At the end of this course, the student should be able to understand the concepts and common parameters of Integrated circuits (IC). The course will build enough confidence among the learners about the handling and use of commercially available IC's for various practical applications.

Suggested / Reference Books:	
1	Op–Amps & Linear Integrated Circuits: Ramakant A. Gayakward, 3rd Edition, Pearson Education.
2	Linear Integrated Circuits: S.P. Bali, Tata Mc-Graw Hill
3	Operational Amplifiers with Linear Integrated Circuits: 4th Edition, William D. Stanley

Course Name	**:**	**Electromagnetic Field Theory**
Course Code	**:**	**ECL-221**
Credits	**:**	**4**
L TP	**:**	**3-1-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
At the end of this course, the student should be able to solve Maxwell's equations and study propagation problems involving plane waves. This course introduces the basic knowledge of the electromagnetic field theory with particular emphasis on the analysis and design techniques of simple electromagnetic components, such as transmission lines and wave guides.

Total No. of Lectures –48

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1 **2**	**Introduction:** Review of Electrostatics and Magnetostatics. **Time Varying Fields:** Maxwell's equations in differential and integral forms concept of displacement current. Boundary conditions.	10
	SECTION - B	
3 **4**	**Electromagnetic Waves:** Wave equation and its solution in different media, plane wave, sinusoidal time variations, polarization, Reflection of waves by perfect dielectrics and by perfect insulators. Surface impedance, Pointing theorem and pointing vector. **Guided Waves:** Waves between parallel planes, TE and TM waves and their characteristics. TEM wave, velocities of waves. impedance. SECTION–II 3. Antennas: Aperture antennas, Horn Antennas and Reflector antennas.	14

SECTION – C		
5	**Wave Guides:** Rectangular and circular wave guides. TE and TM waves in rectangular wave guides. Impossibility of TEM wave in wave guides. Wave impedances and characteristics impedances. Transmission line analogy for wave guides. Attenuation and factor of wave guides. Dielectric slab wave guides.	12
SECTION - D		
6	**Transmission Lines:** Circuit representation of parallel plane transmission lines. Parallel plane transmission, plane with losses. Low loss RF and UHF transmission lines. Distortion less condition. Transmission line charts. Impedance matching.	12

Course Outcomes:	
1	Students will be able to analyze and design transmission line networks, including the solution of practical impedance matching problems.
2	To acquire the knowledge of Electromagnetic field theory that allows the student to have a solid theoretical foundation to be able in the future to design emission , propagation and reception of electro- magnetic wave systems
3	Use sections of transmission line sections for realizing circuit elements.
4	Calculate reflection and transmission of waves at media interface.

Suggested / Reference Books:	
1	E.C Jordan and K.G. Balmain, Electromagnetic waves and Radiating Systems, Prentice Hall, India.
2	R.K Shevgaonkar, Electromagnetic waves, Tata McGraw Hill India.
3	Kraus, Fleisch, Electromagnetics with Applications, Tata McGraw-Hill, 5th Ed.

Course Name	**:**	**Communication Signals & Systems**
	:	**ECL-222**
Credits	**:**	**4**
L TP	**:**	**3-1-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

The objective of this subject is to develop analytical and problem solving capability of students, by which they would be able to understand and handle real-time signal processing related problems and projects. The knowledge of basics of signals and systems, Convolution and sampling operations, Fourier series analysis, different types of transforms such as Fourier Transform, Laplace transform and Z transforms, random signal theory will help students to work in multi-disciplinary fields of engineering in group activities.

Total No. of Lectures –48

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	**Signals, Systems and Analysis:** Classification and representation of signals & systems with their properties, Impulse response and step response of a system, Time and Frequency domain analysis, Energy and power spectral density.	10
	SECTION - B	
2	**Fourier Representation:** Continuous and discrete time Fourier series, Trigonometric & exponential Fourier series, Properties of Fourier series, Parseval's theorem, Continuous and discrete time Fourier transforms and its properties, Analysis of discrete time signals and systems, Correlation, Autocorrelation, Relation to Laplace transform and Z-Transform.	14

	SECTION - C	
3	**Signal Transmission Through Linear Networks:** Sampling theorem – Graphical and analytical proof for Band Limited Signals, Types of Sampling - Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass sampling. Correlation of Signals, Concept of convolution theorem in Time domain and Frequency domain, Graphical representation of Convolution	14
	SECTION - D	
4	**Random Signals:** Probability, Random variables, Gaussian distribution, Transformation of random variables, Random processes, Stationary processes, Correlation and Covariance Functions, Regularity and Ergodicity, Gaussian Process, Transmission of deterministic and indeterministic signals through a linear time invariant system, Spectral density.	10

Course Outcomes:	
1	Acquired knowledge about classification of signals and systems, different properties of signals and systems.
2	Gained knowledge about Fourier series and Fourier transform analysis of signals
3	Acquired knowledge about convolution theorem and sampling theorem for low pass and band pass filters.
4	Obtained basic idea about Random Signals & probability.

Suggested / Reference Books:	
1	Oppenheim, A.V., Willsky, A.S. and Nawab, S.H., “Signals & Systems”, 2nd Ed., Prentice-Hall of India.
2	Haykin, S. and Van Been, B., “Signals and Systems” 2nd Ed., John Wiley & Sons.
3	Lathi, B. P., “Linear Systems and Signals”, 2nd Ed., Oxford University Press.
4	Anand Kumar, A., “Signals and Systems”, 2nd Ed., Prentice-Hall of India

Course Name	**:**	**FIBER OPTICS**
Course Code	**:**	**ECL–224**
Credits	**:**	**5**
L T P	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

The aim of this course is to introduce students about the basics of fiber optics. The course should empower the students to understand the number of physical phenomenon inside the fiber medium and their applications.

Total No. of Lectures – 42

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	A General Introductory Discussion: Elementary discussion of propagation in fibers using a Ray Model Attenuation of Optical fiber.	4
2	Signal Degradation in Optical Fibers: Attenuation, absorption, scattering losses and bending losses in optical fibers.	4
3	Signal distortion in optical wave guide due to material dispersion and wave guide dispersion	4
	SECTION - B	
4	Mode Theory of Circular Wave Guide: Wave equation in step index fiber, model equation, modes in step index fiber, power flow in step index fiber, modes in graded index fiber.	8
5	Fiber Materials and Fabrication: Fiber materials–Doping of fiber material, Glass fibers, plastic clad glass fibers, plastic fibers, fiber fabrication, drawing and coating.	5
	SECTION - C	
6	Optical Sources: Light emitting diode, laser diode, modes and threshold conditions, resonant frequency.	6
7	laser diode structure, single mode laser, modulation of laser diode light source linearity, reliability considerations.	6

SECTION - D		
10	Optical Fiber Sensors: Physical phenomena for optical fiber sensor, temperature sensor, pressure sensor, liquid level sensor.	5

PRACTICALS -: LIST OF PRACTICALS

1. To study temperature characteristics of optical Fiber.
2. To measure numerical aperture of different types of optical Fiber.
3. To study different losses due to optical fiber and components.
4. To determine exact length of optical fiber.
5. To study and compare LED and LASER output characteristics.
6. To determine effect of temperature on laser output power.
7. To study diffraction experiments using LASER.
8. To study characteristics of optical coupler.

Course Outcomes:	
1	Students will be able to understand pros and cons of domain "fiber optics" compared to existing electrical and wireless domain based systems.
2	Students will be able to understand many physical phenomenon inside a fiber medium and able to learn how to use them in applications like sensors and telecommunication.

Suggested / Reference Books:	
1	Chai Yeh–Hand Book of Fiber Optics, Academic Press.
2	Ghatak &Thyagarajan–Optical Electronics, Cambridge University Press.
3	Keiser – Optical fiber Communication, McGraw Hill.
4	John Gower– Prentice Hall of India Pvt. Ltd. Optical Communication System. Education.

Course Name	**:**	**Electronic Design and Implementation Lab.**
Course Code	**:**	**ECP-226**
Credits	**:**	**2**
L TP	**:**	**0-0-2**

Students are required to design simple electronic circuits (Digital, Analog or mixed) as directed by the class teacher. Students should be made aware of the requirement and function of all the components used in the circuit from circuit designing point of view. An introduction about the different designing techniques used nowadays should also be given to the students of this subject.

Course Name	**:**	**Linear Control System**
Course Code	**:**	**ECL-261**
Credits	**:**	**4**
L T P	**:**	**3-0-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
The purpose of this course is to introduce and teach students the fundamentals of control engineering. This course aims to provide description of linear control systems, its stability and error analysis in time and frequency domain. Control engineering is one of the fundamental courses and is a gateway course to many engineering subjects

Total No. of Lectures –36

Lecture wise breakup		**Lectures**
	SECTION - A	
1	**Introduction:** Plant, Systems Servomechanism, regulating systems, disturbances, open loop control system, closed loop control systems, linear and non–linear systems, time variant & invariant, continuous and sampled data control systems, block diagrams, some illustrative examples.	9
2	**Modelling:** Formulation of equation of linear electrical, mechanical, thermal pneumatic and hydraulic system, electrical and mechanical analogies. Transfer function, concepts of state variable modelling. Block diagram representation and reduction, signal flow graphs and associated algebra, characteristics equation, transfer function of discrete data system.	

	SECTION - B	
3 4	**Time Domain Analysis:** Typical test– input signals, transient response of the first and second order systems. Time domain specifications, dominant closed loop poles of higher order systems, Steady state error and co–efficient, Pole–zero location and stability, Routh – Hurwitz criterion, stability of discrete data systems, steady state error analysis of discrete data systems. **Root Locus Techniques:** The extreme points of the root loci for positive gain. Asymptotes to the locii breakaway points, intersection with imaginary exits, location of roots with given gain & sketch of the root locus plot, root loci of discrete data control system.	10
	SECTION - C	
5	**Frequency Domain Analysis:** Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specification relative stability, relation between time and frequency response for second order systems. M and N–circles, Lag magnitude versus Phases angle plot, Nyquist criterion, frequency domain analysis of discrete data systems.	9
	SECTION - D	
6 7	**Compensation:** Necessity of compensation series and parallel compensations, compensating network, application of lag and lead compensation. **Control components:** Error detectors – potentiometers and synchronous, servo motor A.C and D.C. techno generators, magnetic amplifiers.	8

Course Outcomes: After completion of this course, the students would be able to::	
	• Learn the representation of systems, their transfer function models • Find the time response of systems subjected to test inputs and the associated steady state/dynamic errors • Analyze the concept of stability in time domain and frequency domain • Learn basics of compensation • Use of various control components

Prescribed Books:	
1	Nagrath IJ and Gopal M, “Control System Engineering”, Wiley Eastern
2	Dorf RC and Bishop RH, “Modern Control System”, Addison
3	Ogata K, “Modern Control Engineering”, Prentice Hall
4	Kuo B C, “Automatic Control System”, Prentice Hall

PRACTICALS -: LIST OF PRACTICALS

Section A

Some experiments are to be performed using software tools such as MATLAB & SIMULINK.

To study input–output characteristics of a potentiometer and to use two potentiometers as an error deflector.

Section B

To study transmitter–receiver characteristics of a synchro set and to use the set as control component.

To study the operation of a D–C positional servo system and to investigate the effect of damping and supply voltage on its response.

Design of a suitable cascade compensator for the given system and verify the resulting improvement.

Section C

Study of Simulated Relay Control System.

To design different compensating network for the given cut off frequencies and to plot frequency response of these networks.

To simulate a servo–system and obtain its characteristics with the use of controllers

Section D

To study PID – Controller and to obtain the effect of proportional, integral and derivative control action.

Study of the performance of first, second and third order system.

Course Name	**:**	**ELECTRICAL AND ELECTRONIC MEASUREMENTS**
Course Code	**:**	**ECL-262**
Credits	**:**	**4**
L T P	**:**	**3-0-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION-A

1. **Units, Dimensions and Standards:**
   SI Units, Determination of absolute units of current and resistance, Standards of EMF, Resistance, Capacitance, Mutual inductance and their construction, Equivalent circuit representation, Figures of Merit, Construction of variable standards and Decade Boxes.
2. **General Theory of Analog Instruments:**
   Primary and secondary instruments, Indicating recording and integrating types, operating torques damping and controlling torques, Torque/ weight ratio, pointers and scales.

SECTION-B

3. **Analog Measuring Instruments:**
   Principles of operation, Construction, Errors, calibration, areas of application of the following types of instruments for measurement of voltage, current, power, energy, frequency and power factor: (a) PMMC (b) Dynamometer (c) Moving Iron (d) Induction (e) Thermal (f) Electrostatic Extension of Ranges by Shunts. Multipliers: Power and Energy Measurements in Poly phase Circuits.
4. Potentiometers (Only Principles, Operation & applications of DC & AC potentiometer)
   (a) Simple concepts of potentiometers.
   (b) Principle of DC potentiometer, applications.
   (c) Principle operation of AC potentiomerter with advantages/ Disadvantages/ applications.

SECTION-C

5. **Measurement of Resistances;–**
   Low, Medium & High Resistance their measurement.
6. **Bridges:**
   Measurement of R,L,C,M,O by wheat stone, Kelvin, Maxwell Hay, Anderson, Owen, Heaviside, Campbell, Schering, Wien bridges, Bridge sensitivity, Errors, Detectors, Shielding and screening, Wanger ,Earthing.

SECTION-D

7. **Instrument Transformers**
   Theory and construction of current and potential transformer, ratio and phase angle error and their minimization, testing of CTS & PTS.
8. **Cathodes Ray Oscilloscopes:**
   Principles and working of CRO, CRO– probes, Measurement of voltage, frequency and phase angle with CRO.

Recommended Books:

1. Electrical & electronic Measurement and Instrumentation by A.K. Sawhney.
2. Basic Electrical Measurement by B. Shout.
3. Electronic Instrumentation and Measurement techniques by W.D. Cooper.

PRACTICALS:

LIST OF EXPERIMENTS:

1. Measurement of inductance by Maxwell's Bridge.
2. Measurement of small resistance by the Kelvin's Bridge.
3. Measurement capacitance of the Schering bridge.
4. Measurement of frequency by main bridge.
5. Drawing of the B–H loop of a toroidal specimen by using a flux meter.
6. Calibration adjustment of single phase energy meter.
7. Measurement of displacement with the help of potentiometer.
8. Determination of frequency & phase angle using CRO's.
9. Measurement of medium resistances with the help of Wheatstone bridge.
10. Measurement of leakage factor with flux meter.
11. To use low pass RC ckt. As an integrator for square pulses. To verify the time constant and observe its effect on the output wave form so as to chose its optimum value. Also to calculate the time constant graphically.
12. To observe the response of an R.L.C. ckt. to A.C. input. Determine the phase shift between the applied voltage and current making use of lissajous figures. Compare the result with theoretical one calculated from the ckt. parameters.
13. To verify voltage current relationship in a linear ckt. with non sinusoidal A.C. supply.
14. To find the Q. of a coil by a series resonance method and verify it by using Q. meter.
15. To convert a four terminal network to a three terminal network i.e. equivalent T network.

SCHEME

SEMESTER – V

S. No.	Course Code	Course Title	L	T	P	Credits
1.	ECL327	Machine Learning	3	0	1	4
2.	ECL311	Analog Communication	3	1	1	5
3.	ECL312	Microprocessor and Its Applications	3	1	1	5
4.	ECL313	Antenna & Wave Propagation	3	1	0	4
5.	ECL318	Computer Network	4	0	0	4
6.		Elective – IV	2	1	1	4
7.	ECP315	Industrial Training**	– S/US –			0
			18	4	4	26
List of Elective IV						
1.	ECL–352	Industrial Electronics	2	1	1	4
2.	ECL-353	Instrumentation and Industrial Automation	2	1	1	
3.	CSL-344	Object Oriented Programming using JAVA	2	1	1	

**** The result will be satisfactory or unsatisfactory.**

SEMESTER – VI

S. No.	Course Code	Course Title	L	T	P	Credits
1.	UBS-052	Entrepreneurship & Business Strategy	4	0	0	4
2.	ECL-321	Microwave Engineering	3	1	1	5
3.	ECL322	Digital Communication	3	1	1	5
4.		Elective – V	3	0	0	3
5.		Elective – VI	3	0	1	4
6.	ENL351	Communication Skill for Engineers	2	1	0	3
7.	ECP324	Project	0	0	4	4
		Total Credits:	18	3	7	28
List of Elective V						
1.	ECL–362	Bio–medical Electronics	3	0	0	3
2.	ECL–363	VLSI Technologies and Design	3	0	0	
3.	ECL–364	Virtual Instrumentation	3	0	0	
4.	ECL–367	Software Engineering	3	0	0	
5.	ECL–368	Operating System	3	0	0	
List of Elective VI						
1.	ECL–365	Micro Controllers	3	0	1	4
2.	**ECL-370**	**Digital System Design**	3	0	1	

Course Name	**:**	**Machine Learning**
Course Code	**:**	**ECL-327**
Credits	**:**	**4**
L T P	**:**	**3-0-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

- Introduce fundamentals of Machine Learning for real time problem solving
- Provide thorough understanding of different kinds of machine learning algorithms and its mathematical concepts in order to get deep insights in the area of data analytics.
- Understanding of deep learning and reinforcement learning models to further enhance problem solving capabilities in different areas of research.
- To have understanding of performance measures for evaluating the performance of deep learning algorithms.

THEORY

Total No. of Lectures – 42

	Lecture wise breakup	Number of Lectures
	SECTION - A	
1	**Introduction:** Introduction to Machine learning, types: supervised learning, unsupervised learning and reinforcement learning, applications of machine learning, model representation **Supervised Learning algorithms:** Multilayer perceptron or Back propagation neural network, Radial basis function neural network, Bayesian Network, Naïve Bayes Classifiers, Decision tree, linear regression, logistic regression.	12

	SECTION - B	
2	**Unsupervised Learning Algorithms:** K-means Clustering, Hierarchical clustering **SVM & Ensemble Machine Learning models:** brief introduction to Support Vector Machine (SVM), Fundamental concept of Ensemble Machine Learning techniques such as Bagging, Boosting.	10
	SECTION - C	
3	**Deep Learning:** Basics of Deep learning, Auto-encoders, Convolutional Neural Network, Recurrent Neural Network: LSTM. **Learning Fundamentals:** Gradient descent learning technique, Overfitting, regularization, Dimensionality reduction using Principle component analysis, a general view of feature extraction, feature ranking, Validation techniques, Confusion matrix and its related performance parameters.	11
	SECTION - D	
4	**Reinforcement Learning:** Introduction, Markov decision process (MDP), Bellman equations, Value iteration and policy iteration, Q-learning, Value function approximation, Policy search, Reinforce, POMDPs, Temporal Difference Learning.	9

Suggested / Reference Books:	
1	Ethem Alpaydin, Introduction to Machine Learning, Third Edition, Prentice Hall of India.
2	Tom M. Mitchel, Machine Learning, Tata McGraw-Hill Education India , 1st Edition
3	Manaranjan Pradhan and U Dinesh Kumar, Machine Learning using Python, Wiley India.
4	Anuradha Srinivasaraghavan, Vincy Joseph, Machine Learning, Wiley India.
5	Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr. D Karthika Renuka, Deep Learning using Python.
6	Yegnanarayana, B., Artificial Neural Networks, Prentice-Hall of India Private Limited (2008).
7	Petterson, D.W., Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India (2007).
8	Zurada, J.M., Introduction to Artificial Neural Network System, Jaico Publication (2006).

9	Sivanandam S.N., Principles of Soft computing, Wiley India.

PRACTICAL

List of Experiments		**Number of Turns**
1	Introduction to *Numpy, Scipy, Scilearn-kit, Pandas, keras, matplotlib* and *tensor-flow* packages in python	**1**
2	Build an ANN model with back propagation neural network approach with .csv datasets for classification problem. Compute accuracy of the classifier by considering test dataset.	**2**
3	Build Classification and/or Regression models using Bayes Net, Naïve Bayes, and Logistic regression models for given datasets in Python. Compute classification accuracy of these models using confusion matrix.	**3**
4	Use decision tree algorithm for classification problem using given dataset. Compute classification accuracy, precision and recall values using confusion matrix.	**2**
5	Use k-means clustering algorithm to cluster data stored in .csv dataset.	**2**
6	Image classification problems using Convolutional Neural Networks.	**2**
7	Sequence classification problem using LSTM Network in Python.	**2**

Course Outcomes:	
1	The students will be able to solve various real time problems related to image classification, signal processing and classification, marketing, finance, healthcare and other engineering problems in the field of data analytics.
2	The theoretical understanding of machine learning and deep learning algorithms and its implementation in Python make the students familiar with its deep insights and enable them to further enhance their problem-solving capability.

Course Name	**:**	**Analog Communication**
Course Code	**:**	**ECL-311**
Credits	**:**	**5**
L TP	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

The main objective of this course is to acquire basic understanding of an analog communication system. The course will describe the theory of modulation and its different types with the help of block diagrams. Mathematical analysis and waveform representations. The course will also focus on the design of AM and FM transmitters and receivers and its performance analysis based on various performance measures. This course also will also cover basic pulse modulation and demodulation techniques such as Pulse Amplitude Modulation, Pulse Position Modulation and Pulse Width Modulation.

THEORY

Total No. of Lectures –42

	Lecture wise breakup	Number of Lectures
	SECTION - A	
1	**Analog Modulation Techniques:** Introduction to Communication system, Block Diagram, Need for Wireless Communication and Modulation, Types of various Signals. Theory of Amplitude Modulation, AM Power and Current Calculations, AM Modulation with a Complex wave, Theory of Frequency Modulation: Mathematical analysis of FM Spectra of FM Signals, Narrow band FM, Wide band FM, Theory of Phase Modulation, Phase Modulation obtained from Frequency Modulation and vice versa.	6

SECTION - B		
2	**AM Transmission:** Introduction, Basic Principle of AM Generation, Low Level and High Level Modulation, Square Law Diode Modulation, Balanced Ring Modulator, Comparison of DSBFC, DSBSC and SSB transmission.	6
3	**AM Reception:** Introduction, AM Receiver Parameters, Tuned Radio Frequency (TRF) Receiver, Super heterodyne Receiver, Basic Elements of AM Super-heterodyne Receiver, Frequency Conversion, Image Frequency Rejection, Tracking and Alignment,	10
SECTION - C		
4	RF Amplifiers, Neutralization of RF Amplifiers, Mixers and types of mixer, AM Detector: Square law Detector, Envelope or Diode Detectors, AM Detector with AGC, AM Receiver Using a phase locked loop (PLL), Double hetero-dyne Receiver, Introduction to SSB (Single Side Band) Reception. **FM Transmission:** FM Allocation Standards, Generation of FM by Direct Method: Varactor Diode Modulation, Reactance Modulation; Indirect Generation of FM: The Armstrong Method, FM Stereo Transmitter.	6
5	**FM Receptions:** Introduction to FM Receiver, Direct Methods of Frequency Demodulation, Travis Detector/Frequency Discrimination (Balanced Slope Detector), Foster Seeley or Phase: Discrimination, Ratio Detector, Indirect Method of FM Demodulation, Pre-emphasis and de-emphasis, Limiters, FM Stereo Receiver.	8
SECTION - D		
6	**Pulse Modulation** Introduction, Definition, Generation of Pulse Amplitude Modulation (PAM), Natural PAM, Flat-top PAM, Modulation and demodulation of PAM Signals, Generation of Pulse Width Modulation and Demodulation (PWM), Generation of Pulse Position Modulation and Demodulation (PPM), Comparison of Analog and Pulse Modulation.	8

Suggested / Reference Books:	
1	Communication Systems by J. Dass Wiley Eastern, 2007.
2	Digital and Analog Communication Systems by K Sham Shanmugam (John Wiely & Sons), 2007.
3	Electronic Communication Systems by Wayne Tomasi Pearson Education Fifth Edition, 2007.
4	Modern Digital and Analog Communication Systems by B.P. Lathi, Zhi Ding (Oxford University Press), Fourth Edition, 2010.

5	Electronic Communication Systems by Bernard Davis, S.R.M. Prasanna, Goerge Kennedy, Tata McGraw- Hill Education, Fifth Edition, 2012.

PRACTICAL

List of Experiments		**Number of Turns**
1	To amplitude modulate the information signal with a high frequency carrier and observe input/output waveforms on the CRO.	**1**
2	To study the input and output waveforms of amplitude demodulator circuit.	**1**
3	To frequency modulate the information signal with a high frequency carrier and observe input/output waveforms on the CRO.	**1**
4	To study the input and output waveforms of frequency demodulator circuit.	**1**
5	To study the sensitivity of a superheterodyne receiver.	**1**
6	To study the selectivity of a superheterodyne receiver.	**1**
7	To study the fidelity of a superheterodyne receiver.	**1**
8	Study of Pulse amplitude modulation/demodulation.	**1**
9	Study of Pulse width modulation/demodulation.	**1**
10	Study of Pulse position modulation/demodulation.	**1**
11	To study the operation of balanced modulator.	**1**
12	Experiments related to AM, FM and PM modulation and demodulation are to be performed using MATLAB/Simulink.	**2**

Course Outcomes:	
1	Basic understanding of Analog communication system and its various building blocks
2	Gained knowledge about different types of modulation techniques such as AM, FM and PM using basic block diagrams, waveforms and mathematical analysis.
3	Acquired knowledge about design of different AM and FM transmitters and receivers and its performance analysis based on various performance measures.

4	Ability to understand basic analog pulse modulation techniques such as PAM, PWM and PPM etc.

Course Name	**:**	**MICROPROCESSOR AND ITS APPLICATIONS**
Course Code	**:**	**ECL–312**
Credits	**:**	**5**
L TP	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
At the end of the course, students will be able to understand various concept related to hardware of microprocessor, memory and assembly language programming.

Total No. of Lectures –48

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	**Introduction to Microprocessors**: Need for Flexible Logic and Evolution of Microprocessors, Applications, Generic Architecture of a Microprocessor. **Basic Input/Output Techniques**: Serial I/O, Parallel I/O, Programmed I/O, Interrupt Driven I/O, Direct Memory Access.	8
	SECTION - B	
2	**INTEL 8085 Microprocessor**: Pin Functions, Architecture, Addressing Modes, Instruction Set, Data Transfer Instructions, Arithmetic, Logical and Rotate Instructions, Branching and Machine Control Instructions, Timing Diagrams, Interrupts, Programming Examples.	16

SECTION - C		
3	**INTEL 8086 Microprocessor**: Pin Functions, Architecture, Characteristics and Basic Features of Family, Segmented Memory, Addressing Modes, Instruction Set, Data Transfer Instructions, Arithmetic, Logical, Shift & Rotate Instructions, Flag Control Instructions, Transfer of Control Instructions, Processor Control Instructions, Programming Examples, Interrupt Structures, **INTEL 8086 System Configuration**: Clock Generator (8284), Bus Controller (8288), MIN/MAX Modes of 8086 and System Configurations.	16
SECTION - D		
4	**Peripheral Controllers**: USART (8251), Programmable Peripheral Interface (8255), Programmable Interrupt Controller (8259), Programmable Keyboard and Display Interface. **Advanced Microprocessors**: Main features, comparison of 80186, 80286, 80386, 80486 and Pentium processors.	8
Course Outcomes:		
	At the end of this course students will demonstrate the ability to 1. Do assembly language programming 2. Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.	

Suggested / Reference Books:	
1	R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing.
2	D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.
3	Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill,
4	W. A. Triebel, Avtar Singh, The 8088 and 8086 Microprocessors : Pearson Edu Asia

PRACTICAL:

1. Simple programs for sorting a list of number in ascending and descending order.
2. Sorting a list without destroying the original list.
3. Code conversion – Binary to Gray/Gray to Binary.
4. Program for addition of BCD numbers.
5. Program for multiplication of 8 bit numbers using Booth's algorithm.
6. Interface an LED array and 7–segment display through 8255 and display a specified bit pattern/character sequence at an interval of 2 seconds.
7. Generate the given waveform using a DAC after interfacing it with a microprocessor kit, Use any PPI port.
8. Interface an ADC chip with microprocessor kit and verify its operation with d.c. and low frequency inputs. Use of PPI port and sample and holds is required.
9. Interface an external 8253 to the micro processor kit at the address given.
   Hence,
   I. Generate a pulse train of specified duty cycle at the given output line, operate as a N counter
   II. Count a train of pulses for a given duration.
10. Interface the given microprocessor kit to a personal computer through R.S.–232C. The band rate is specified. Verify data transfer in both directions (P–PC and PC–P).
11. Interface a given printer to the micro processor kit using on board 8255.
12. Interface an external keyboard to a microprocessor kit through on board 8255.
13. Write a program to demonstrate rolling display from left–to–right using 8279. Do not use any built in routines, instead program the 8279.
14. Use the SOD line to generate a square wave of the specified duty cycle at a given frequency.

Course Name	**:**	**ANTENNA AND WAVE PROPAGATION**
Course Code	**:**	**ECL-313**
Credits	**:**	**4**
L TP	**:**	**3-1-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
At the end of this course, the student should be able to understand the antennas, their principle of radiation, their basic parameters (radiation resistance, radiation pattern, polarization, reciprocity, beamwidth, directivity etc.), analysis and their applications, their general types, and those commonly used in wireless systems. The student learns how to perform analysis to determine the fields radiated from antennas and their ordered arrays. The course introduces the student to the basic modes of propagation and the various propagation mechanisms/impairments. Concept of Electromagnetic Compatibility is also introduced.

Total No. of Lectures –

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	Concept of Radiation: Physical concept of radiation, retarded potential, radiation from a hertizian, short and a half wave dipole, Radiation mechanism: single wire, two wire and dipole, Near and Far fields. Concept of Electromagnetic interference, EMC, advantages of EMC.	10
	SECTION - B	
2	Antenna Parameters and Types: Radiation pattern, directivity, gain; radiation resistance effective aperture, input impedance, Friis transmission equation, noise temperature, reciprocal properties, elementary ideas about self and mutual impedance. Aperture, Horn and Reflector Antennas. impedance. SECTION–II 3. Antennas: Aperture antennas, Horn Antennas and Reflector antennas.	10

SECTION – C		
3	Antenna Arrays: Arrays of point sources, array factor, array pattern multiplication, N-element linear array: Uniform amplitude and spacing, Uniform Spacing and Non-uniform Amplitude, End fire array and Broadside array, Beam width, Directivity, Binomial and Tschebyscheff arrays, Super directivity.	12
SECTION - D		
4	Wave Propagation: Basic idea of ground wave, surface wave and space wave propagation, troposphere propagation and duct propagation. Structure of ionosphere, reflection and infraction of waves by ionosphere, regular and irregular variations of the ionosphere qualitative discussion of propagation through ionosphere, vertical height, maximum usable frequency, skip distance, LOS distance and effective earth's radius.	8

Course Outcomes:	
1	To analyze the fundamentals of antenna theory and their radiation patterns
2	Develop the basic skills necessary for designing a wide variety of practical antennas and antenna arrays.
3	To discuss radio wave propagation and to identify the atmospheric and terrestrial effects on radio wave propagation.

Suggested / Reference Books:	
1	Antenna, Krous, J.D., McGraw Hill
2	Antennas Theory and Design, C.A. balanis, Row and Harper
3	Antenna and Wave Propagation, K.D Prasad, Satya Prakhan
4	Antenna Theory and Practice, R. Chatterjee, Wiley Eastern
5	Antennas and Radio wave Propagation, Collins, R.E. McGraw Hill

Course Name	**:**	**Computer Network**
Course Code	**:**	**ECL-318**
Credits (L-T-P)	**:**	**4 (4-0-0)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage
Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

1. To make students aware about different type of media used in networking.
2. To make students aware about international standards (e.g. 802.11a) of switches,routers,hubs, bridges.
3. To make students aware about different applications of each layer.

Total No. of Lectures –48

Lecture wise breakup		**Number of Lectures**
SECTION – A		
1	Introduction: – Network architecture – protocol implementation issues – Quantitative performance metrics – network design. Reference models – The OSI Reference Model – The TCP/IP Reference Model – A Comparison of the OSI and TCP/IP Reference Models. Low-level network technologies: – Ethernet to token ring to wireless-Issues with data link protocols – Encoding framing and error detection and correction – Sliding window protocol – Medium access control sub layer – Basic models of switched networks – Datagrams versus virtual circuits – Switching technologies – Switched Ethernet and ATM – The design of hardware based switches.	12

SECTION – B		
2	Network layer: – Network layer design issues – Routing algorithms – Congestion control algorithms – Internetworking – The network layer in the internet – Internet Protocol (IP) – Unicast, multicast, and inter domain routing.	12
SECTION – C		
3	Transport layer: – Elements of transport protocol – Congestion control – Performance issues – The Internet's Trans-mission Control Protocol (TCP) – Remote Procedure Call (RPC) – Implementation semantics of RPC – Client-Server applications – The Real-time Transport Protocol (RTP) – Multimedia applications – Congestion Control and Resource Allocation – Congestion control in TCP – UDP – Quality of service in IP.	12
SECTION – D		
4	Application layer: – Domain name server – World Wide Web – Hyper text transfer protocol – Presentation formatting and data compression – Network security – crypto graphic tools – the problems of key distribution – Several authentication techniques – Pretty Good Privacy (PGP) – Secure Shell (SSH) - IP Security architecture (IPSEC) – Firewalls. Network applications and the protocols: – File transfer protocol – email and the web, multimedia applications such as IP telephony and video streaming – Overlay networks like peer-to-peer file sharing and content distribution networks – Web Services architectures for developing new application protocols.	12

Course Outcomes: After study of this subject the student	
1	Will be familiar to OSI and TCP/IP reference Models.
2	Can understand different components in networking.
3	Will learn the importance of every protocol in each layer.

Suggested / Reference Books:	
1	Larry L Peterson, Bruce S Davis, Computer Networks, 5th Edition, Elsevier, 2012.
2	Andrew S. Tanenbaum, David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010.
3	Behrouz A. Forouzan, Data Communication & Network, Mcgraw Hill, 5th Edition, 2014.

Course Name	**:**	**INDUSTRIAL ELECTRONICS**
Course Code	**:**	**ECL–352**
Credits	**:**	**4**
L TP	**:**	**2-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the

1. Various types of power semiconductor devices and their characteristics.
2. Drive requirements of a semiconductor power switch.
3. Operation and characteristics of various types of power electronic converters with their applications.

Total No. of Lectures –36

	Lecture wise breakup	**Number of Lecture**
	SECTION - A	
1	Thyristor: Introduction, Static and switching characteristics, Two transistor analogy, Turn on and turn off methods, Ratings and protection of SCR, Series and parallel connection of SCRs, Structure and operation of diac, triac, UJT, power MOSFET.	9
	SECTION – B	
2	Phase Controlled Rectifiers: Single phase and three phase of half wave and full wave-controlled rectifiers with R, RL, freewheeling diode and RLE loads. Cyclo-Converters: Principle, Step up and step down cyclo-converters-single phase to single phase and three phase to single phase.	9
	SECTION – C	

3	Choppers: Principle, control strategies, Types of choppers - buck, boost and buck-boost choppers, Voltage, current and load commutated choppers, Switched mode power supplies topologies, Chopper control of DC drives in different modes.	9
SECTION – D		
4	Inverters: Single phase voltage source bridge inverter, Modified McMurray half bridge inverter, Three phase bridge inverter with 180 degrees and 120 degrees modes, Pulse width modulation inverter, Series inverter, Parallel inverter.	9

Course Outcomes:	
1	Understand the importance and requirement of power electronics in engineering.
2	Select the power devices as per the applications and usage for energy conversion and
3	Choose appropriate power converter and develop their triggering and commutation circuits
4	Interpret and use datasheets of power semiconductor devices for design.

Suggested / Reference Books:	
1	Power Electronics – P.C. Sen, Tata McGraw Hill Publishing Co. Ltd., 2007.
2	Power Electronics and Control– S.K. Dutta, Prentice Hall of India Pvt. Ltd., 2006.
3	Industrial Electronics SN Biswas Dhanpat Rai & Sons, 2005.
4	Thyristor Engineering, MS Berde, Khanna Publication, 2005.
5	Power Electronics, PS Bimbra, Khanna Publication, 2004.

PRACTICAL:

1. To draw the static characteristics of SCR, Diac, Triac,UJT, Power MOSFET.
2. To determine frequency of a relaxation oscillator for various values of C.
3. To study the commutation circuits.
4. Study of the half wave controlled rectifier with R and RL load.
5. Study of the full wave controlled mid-point rectifier with R and RL load.
6. Study of the full wave controlled bridge rectifier with R and RL load.
7. To vary the frequency of an inverter circuit.
8. To vary the speed of a dc motor with the help of an SCR.
9. To study the characteristics of SMPS.

Course Name	**:**	**INSTRUMENTATION AND INDUSTRIAL AUTOMATION**
Course Code	**:**	**ECL–353**
Credits	**:**	**4**
L T P	**:**	**2-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

	Lecture wise breakup	**Lectures**
	SECTION - A	
1	**Transducers** - Introduction, generalized measurement system, performance characteristics. Classification, basic working principle of resistive, capacitive, inductive, piezoelectric transducers. Measurement of displacement, velocity, acceleration and force. Measurement of pressure, flow, temperature, liquid level and humidity.	9
	SECTION - B	
2	**Introduction to Programmable Logic Controllers (PLCs) -** PLC evolution, advantages, block diagram, principle of operation. List of various PLCs available, **PLC programming**- Introduction to Logic Ladder Design. Symbols used and simple instructions. Equivalent Ladder Diagram of AND, OR, NOT, XOR, NAND and NOR Gate. Equivalent ladder diagram to demonstrate De Morgan theorem. Programming examples.	10
	SECTION - C	
3	**Data Acquisition Systems (DAS) :** Computers in process control, Data loggers, DAS, Alarms, Direct Digital Control (DDC), Supervisory digital control (SCADA), Introduction & Brief History, SCADA Hardware & Software.	9
	SECTION - D	
4	Applications of PLC's and SCADA in Industrial Automation.	8

PRACTICAL:

Experiments related to PLC programming & experiments using SCADA software to be performed by the students in addition to the basic experiments based on transducers

Course Name	**:**	**OBJECT ORIENTED PROGRAMMING USING JAVA**
Course Code	**:**	**CSL344**
Credits	**:**	**4**
L TP	**:**	**2-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the

1. Programming in the Java, the basic knowledge and working of object-oriented model in the Java programming language.
2. Effective coding technique, basics of input outputs, event handlings and working with the graphics

Total No. of Lectures –34

	Lecture wise breakup	**Number of Lectures**
	SECTION – A	
1	Evolution of Java: Importance of JAVA to internet, Features of JAVA, Bytecode, Object oriented approach. Data Types, Variables and Arrays: Data types, Declaration of variable, Type conversion and casting, One dimensional and multidimensional arrays Operators and Control Structures: Arithmetic, bitwise, relational, boolean, assignment operators, Operator precedence, Selection statements, Iteration statements, Jump statements. Classes: Class fundamentals, Declaring objects, Introducing methods, Constructors, This keyword, Overloading constructors, Recursion, Nested and inner classes.	12

SECTION – B		
2	Inheritance: Creating multilevel hierarchy, Method overriding, Abstract classes. Packages and Interface: Packages, Access protection, Importing packages, Interfaces, defining, Implementing, Applying interfaces, Extending interfaces Exception Handling: Fundamentals, Exception types, Uncaught exceptions, Try and catch. Multithreaded Programming: The Java thread model, Thread priorities, Synchronization, Interthread communication, Suspending resuming and stopping threads.	11
SECTION – C		
3	Java I/O: I/O basics, Streams, Reading console input and writing console output, Print Writer class, Reading & writing Files, Byte streams, Character streams & Serialization. Applets: Applet basics, Applet architecture, Applet display, repaint, parameter passing. Event Handling: The delegation event model, Event classes, Event listener interfaces	12
SECTION – D		
4	AWT: Window fundamentals, Working with frame windows, Graphics, Color and Fonts. Servlets: Life cycle of a servlet, Theservlet API, Reading servlet parameters, Handling HTTP requests and responses, Cookies &Session tracking& ODE's. JDBC: Database programming, Connecting to the database, Creating a SQL query, Getting the results, Updating database data.	10

Course Outcomes:	
1	Understanding of object-oriented programming concepts: abstract data types, encapsulation, inheritance and polymorphism
2	Knowledge of the structure and model of the Java programming language.
3	Use of the Java programming language to develop software in the Java programming language with an effective coding technique that involves soft-coding, use of packages and interfaces with exception handling.
Suggested / Reference Books:	
1	Herbert Schildt, "Java: The Complete Reference", McGraw-Hill, 2007
2	Balagurusamy, "Programming in JAVA", Tata McGraw Hill, 2004
3	Bert Bates, Kathy Sierra, "HeadFirst Java", O'Reilly Media

PRACTICALS:

1. WAP to calculate simple interest taking inputs from the user
2. WAP to implement stack using interfaces.
3. WAP to reverse two numbers and add their reversed form.
4. WAP to check whether a number is palindrome or not.
5. WAP to check weather number is prime or not.
6. WAP to prepare a frame using AWT and build a HUT in that frame.
7. WAP to calculate surface area and volume of a sphere.
8. WAP to check an Armstrong number.
9. WAP to swap two numbers without using third variable.
10. WAP to reverse the entered number.
11. WAP to convert temperature from Celsius to Fahrenheit and vice versa taking scale of input and magnitude from user.
12. WAP to enter weight and height of five people and count how many of them have weight less than 60Kg and height more than 5.5 Feet.
13. WAP to create an array of 10 random integers from 1 to 50 and display them, then prompt the user for an integer, search through the array and count the occurrences of that input number.

Course Name	**:**	**ENTREPRENEURSHIP AND BUSINESS STRATEGY**
Course Code	**:**	**UBS-052**
Credits	**:**	**4**
L T P	**:**	**4-0-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION A
Fundamentals of Entrepreneurship: Nature, Entrepreneurial process. Entrepreneurs: Functions, Types, Traits, difference between managers and entrepreneurs. Creativity and Innovation: creativity process, barriers to creativity, developing individual creativity, enhancing organizational creativity, common sources of new venture ideas
SECTION B
Motivation: concept, theories- Maslow's theory, McClelland theories. Ethics and Social Responsibility of an Entrepreneur. Role of Entrepreneurship in Economic Development. Role of government towards entrepreneurial development
SECTION C
Entrepreneurial decision making. Setting Up a Small Business Enterprise; Business Plan: Elements, Preparation. Sources of finance: Debt/Equity Financing, Support from banks and other financial institutions, venture capital.

SECTION D
Strategic Management: Meaning, levels of strategy. Corporate Vision, Mission, Objectives and goals. Process of Strategy formulation Environment analysis: External and Internal - SWOT analysis, Porter's five forces model, PEST, Value chain analysis, Resource based view, McKinsey's 7s Framework, Generic strategies.

Suggested readings:

1. Hisrich, Robert D, Peters, Michael P, Manimala, M. J., and Shepherd, D. A., *Entrepreneurship*, Tata McGraw Hill, Delhi.
2. Desai, Vasant, *The dynamics of Entrepreneurial Development and Management*, Himalaya Publishing House, Mumbai.
3. Kumar, Arya, *Entrepreneurship*, Pearson.
4. Nag, A, *Strategic management*, Vikas Publishing
5. Chandrasekaran, N., and Ananthanarayanan, P.S., *Strategic Management*, Oxford University Press.
6. Zimmerer, Thomas, *Essentials of entrepreneurship and small business*, Pearson/Prentice Hall. Step by Step Guide For Starting a Business, available at smallb.in

Course Name	**:**	MICROWAVE ENGINEERING
Course Code	**:**	**ECL–321**
Credits	**:**	**5**
L TP	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
At the end of the course, students will be able to understand various microwave systems, components and their properties.

Total No. of Lectures –48

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC. Basics of Rectangular waveguide and Circular waveguide, Concept of Impedance in Microwave transmission. Impedance Matching, Single and Double stub Tuners. use of SMITH CHART.	12
	SECTION - B	
2	Microwave Semiconductor Devices- Classification of Microwave Devices, Basic principle of operation, equivalent circuit, application of Tunnel diode, Gunn diode, IMPATT diode, Read Diode, PIN diode, Microwave Transistors.	12
	SECTION - C	
3	Microwave Passive devices-Voltage and current definitions, Impedance representation of one port, two port and n port junctions; Scattering matrix and its properties, H-plane Tee, E-plane Tee, Magic TEE, directional coupler, attenuators, isolator, Microwave circulators and Rat–Race circuits.	12

	SECTION - D	
4	Microwave Measurements-Measurement of VSWR & Reflection coefficient, impedance using slotted line, Measurement of Power. Microwave Tubes- UHF limitations in conventional tubes, Analysis and operation of Klystron, reflex Klystron, Magnetron, Travelling Wave Tube.	12

Course Outcomes:	
	At the end of this course, students will be able to visualize that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.

Suggested / Reference Books:	
1	Microwave Devices and Circuits – S.Y. Liao, Prentice Hall of India
2	Fundamentals of Microwave Engg. – R.E. Collin, McGraw Hill
3	Microwave Semiconductor Devices and Their Circuit Applications – H.A. Watson,

PRACTICAL:

1. Study of microwave components and instruments.
2. Measurement of crystal characteristics and proof of the square law characteristics of the diode.
3. Measurement of Klystron characteristics.
4. Measurement of VSWR and standing wave ratio.
5. Measurement of Dielectric constants.
6. Measurement of Directivity and coupling coefficient of a directional coupler.
7. Measurement of Q of a cavity.
8. Calculation of the attenuation constant of an attenuator.
9. Determination of the radiation characteristics and gain of an antenna.
10. Determination of the Phase–shift of a phase shifter.
11. Determination of the standing wave pattern on a transmission line and finding the length and position of the short circuit stub.

Course Name	**:**	**Digital Communication**
Course Code	**:**	**ECL-322**
Credits	**:**	**5**
L T P	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
The main objective of this course is to build fundamental understanding of digital communication system. The course will describe different digital techniques such as Pulse Code Modulation, Delta Modulation and Adaptive delta modulation along with different modulation/demodulation techniques such as ASK, PSK, FSK, 8-PSK, 16-PSK, QPSK etc. with mathematical analysis, waveform representation and block diagrams. This course will also provide insights of various information coding techniques. General overview of fundamental concepts of data transmission and reception will also be covered in this course.

THEORY

Total No. of Lectures –48

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	**Digital Modulation Transmission and Reception:** Introduction, comparison of analog and digital signals, advantages and disadvantages of digital communications, elements of digital communication systems, pulse code modulation (PCM), quantization noise, companding, PCM bandwidth, differential PCM, delta modulation (DM), continuously variable slope delta modulator (CVSDM) or adaptive delta modulation. **Line Coding Techniques:** Line Coding & its properties. NRZ & RZ types, signaling format for unipolar, Polar, bipolar (AMI) & Manchester coding	12

SECTION - B		
2	**Digital Carrier Modulation Transmission and Reception:** Introduction, amplitude shift keying (ASK), frequency shift keying (FSK), coherent, non-coherent FSK detection, continuous phase frequency shift keying (CP–FSK), binary phase shift keying (BPSK), quaternary phase-shift keying (QPSK), 8-PSK, quadrature amplitude modulation (QAM) and 8-QAM.Comparison of various digital modulation techniques - bandwidth and power requirements & probability of error.	12
SECTION - C		
3	**Data Transmission & Reception:** Time Division Multiplexing & Frequency Division Multiplexing, TDM–PCM systems–baseband signal receiver, error probability, Optimum filter **Optimum detection**–Matched Filter receiver using maximum SNR criterion. Practical Matched Filter–Detection of signals in digital communication–Parameter estimation. **Introduction to Multiple Access techniques:** TDMA, FDMA, CDMA	12
SECTION – D		
4	**Introduction to Information Theory:** Concept of information and entropy of a source, channel capacity and Shannon's theorem, Shannon-Hartley theorem, Bandwidth-S/N trade-off, source coding: Shannon-Fano coding, Huffman coding, channel coding: Linear block codes, convolution codes.	12

Suggested / Reference Books:	
1	Advanced Electronic Communication Systems 6th by Wayne Tomasi Pearson Education.
2	Wireless Communications Principles and Practices by Rappaport PHI.
3	Mobile Communication by J.Schiller Pearson Education.
4	Wireless Digital Communications Modulation and Spread Spectrum by Dr. Kamilo PHI.
5	Communication Systems (Analog and Digital) by Sanjay Sharma (KATSONS).
6	Satellite Communication by DC Aggarwal Dhanpat Rai Publication.
7	Wireless Communication by Mark Ciampa, Cengage Learning India Edition.

PRACTICAL

List of Experiments	
1	To study the sampling theorem, pulse code modulation (PCM) & reconstruction of signal.
2	To study Delta Modulation & Demodulation & it's characteristics
3	To study Adaptive Delta Modulation & Demodulation.
4	To study Amplitude Shift Keying (ASK) Modulation & Demodulation.
5	To study Frequency Shift Keying (FSK) Modulation & Demodulation.
6	To study Binary Phase Shift Keying (QPSK) Modulation & Demodulation.
7	To study Quadrature Phase Shift Keying (BPSK) Modulation & Demodulation.
8	To study Quadrature Amplitude Modulation (QAM) Modulation & Demodulation.
9	Capture range & Lock range measurement of a PLL.
10	Frequency demodulation using PLL.
11	Experiments related to ASK, FSK and PSK modulation and demodulation are to be performed using MATLAB/Simulink.

Course Outcomes:	
1	Acquired knowledge of digital communication system with different techniques such as PCM, delta modulation etc.
2	Obtained idea of different modulation techniques such as ASK, PSK, FSK, QPSK and QAM etc and also analyzed its performance in terms of data rate, efficient spectral utilization and effect of noise.
3	Ability to understand different information coding techniques which includes source coding and channel coding
4	Acquired knowledge about fundamental concepts of Optimum filter, matched filter etc.

Course Name	**:**	**COMMUNICATION SKILL FOR ENGINEERS**
Course Code	**:**	**ENL-351**
Credits	**:**	**3**
L T P	**:**	**2-1-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

	Lecture wise breakup	**Lectures**
	SECTION - A	
1	**Basic Grammar:** Use of Articles, Prepositions, Degrees of Comparison, Verbs: Kinds and uses, Tenses: Kinds and uses, Subject: Verb Agreement, Active and Passive Voice, Phrases, clauses and sentences, kinds of sentences, Reported speech.	
	SECTION - B	
2	**Basic Composition:** Paragraph writing, Essay writing, Business correspondence, Official reports, Note making. Preparing and delivering presentations Resume writing.	
	SECTION - C	
3	**Basic Phonetics:** The Production of Speech, The Sounds of English, Phonetic Transcription, Syllable and stress, Intonation.	
	SECTION - D	
4	**Basic Conversation:** English in use, English for routine communicative functions, English in common interactive situations, Speech practice, Group discussion. Preparing for interview, conferences and seminars.	

Note: For sections 3 and 4, the students will practice in the language lab.

Suggested / Reference Books:	
1	Written and Spoken Communication in English by Universities Press (India) Private Limited, Hyderabad.
2	Oxford Guide to Effective Writing and Speaking.

ECL–362 BIO–MEDICAL ELECTRONICS

L T P
3 0 0

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION–A

Transducers
Resistive, capacitive, inductive, photo–electric, piezo–electric, thermo electric, mechano–electronic transducers – the pick circuits for each of the transducers.

Electrodes
Half–cell potential electrode impedance, equivalent circuits, micro electrode and micro pipette – their equivalent circuits, – polarisable and non–polarisable electrodes.

SECTION–B

Non–Electrical Parameters
Flow meters, respiration gas volume and rate measurements, pressure measurements and force measurements, temperature measurements.

SECTION–C

Bio–Chemical Measurements
PH, PHCO3, electrophoresis photoelectric calorimeter, spectro–photometer.
X–Rays
Soft and hard X–rays general black diagram of X–ray generator for diagnosis, radiography, angiography, fluoroscopy , CAT.

SECTION–D

Isotopes
Properties, GM Counter, Scintillation counter, Scanners.

Ultrasonics
Principles–modes of displays–application of ultrasonic for diagnosis.

Books Recommended:

1. Bio–Physical Measurement and Measurement Concepts by Peter Strong, Tetronic Inc.
2. Principles of Applied Bio–Medical Instrumentation by Geddes and L.E. Baker, John Wiley Publishers
3. Engineering and Practice of Medicine by Segal and Kilpatric, William and William Co.
4. X–Ray Techniques for Students by M.O. Chesney, Blazewell

Course Name	**:**	**VLSI TECHNOLOGIES & DESIGN**
Course Code	**:**	**ECL-363**
Credits (L-T-P)	**:**	**3-0-0**
Total Marks	**:**	**100**
Mid Semester	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

1. To make students aware about fabrication process of CMOS.
2. Students can compare about NMOS and CMOS.
3. Students will be able to implement inverters using CMOS, NMOS.

Total No. of Lectures –36

	Lecture wise breakup	**Number of Lectures**
	SECTION – A	
1	**IC Fabrication**: Unit process for integrated circuit fabrication, crystal growth, substrate preparation, oxidation, diffusion, photolithography, ion – implantation, epitaxy for Si, chemical vapour deposition techniques and metallization.	9
	SECTION – B	
2	**CMOS**: MOS transistor theory (enhancement and depletion). NMOS and CMOS technology, the pass transistor, inverter design in NMOS and CMOS technology.	9
	SECTION – C	
3	**CMOS Design and Realization**: E/D logic gates in NMOS and CMOS technology, impurity introduction, layer deposition, etching, design rules.	9

SECTION – D		
4	**General design methodologies**: Stick diagrams, polycell and gate away approach, examples of cell design.	9

ourse Outcomes: After study of this subject the student	
1	Will be familiar to different processes in IC fabrication.
2	Can understand the phenomena of deposition techniques.
3	Can implement inverters, adders using CMOS.
4	Will learn about Stick Diagrams.

Suggested / Reference Books:	
1	A.B. Glasser, Ges Sharpe – Integrated Circuit Engineering (Addison Wesley).
2	S.K. Gandhi – VLSI Fabrication Principles (John Wiley).
3	N. Wasle, K. Eshranghian – Principles of CMOS VLSI Design (Addison Wesley).
4	C. Mead, L. Conway – Introduction to VSL VLSI Systems (Addison Wesley)
5	V.L.S.I Technology by SZE. S.M. (McGraw Hill Pb.).

ECL–364 VIRTUAL INSTRUMENTATION

L T P
3 0 0

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION–A

Review of Virtual Instrumentation: Historic perspective, Need of VI, Advantages of VI, Define VI, block diagram & architecture of VI, data flow techniques, graphical programming indata flow, comparison with conventional programming.

Programming Techniques: VIS & Sub VIS, loops & charts, arrays, clusters, graphs, case & sequence structures, formula modes, local & global variables, string 7 file input.

SECTION–B

Data Acquisition Basics: ADC, DAC, DIO, Counters & timers, PC Hardware structure, timing, interrupts, DMA, Software and hardware Installation.

Use of Analysis Tools: Fourier transform, Power spectrum, Correlation methods, windowing & filtering.

SECTION–C

Common Instrument Interfaces: Current loop, RS 232C/RS 485, GPIB, System basics, Interface basics, USB, PCMCIA, VXI, SCXI, PXI etc, networking basics for office & industrial application VISA & IVI, image acquisition & processing, motion control.

SECTION–D

Application of VI: Application in Process Control Projects, Major equipments– Oscilloscope, Digital Multimeter, 120 MHz Pentium computers, Lab view Software, Study of Data acquisition& control using Lab view, Virtual Instrumentation for an Innovative Thermal Conductivity, Apparatus to measure the Thermal Conductivity Apparatus– to measure the conductivity of non Newtonian fluids while they are subjected to sharing force.

Recommended Text Books:

1. Gary Johnson, Lab View Graphical Programming, Second Edition, Mc Graw Hill, New York, 1997.
2. Lisa K.Wells & Jeffrey Travis, Lab view for Everyone, Prentice Hall, New Jersey, 1997

Course Name	**:**	**Software Engineering**
Course Code	**:**	**ECL-367**
Credits (L-T-P)	**:**	**3-0-0**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

1. To learn about the mathematical analysis and principles of computer science in order to design and develop computer software.
2. To develop understanding with a detailed knowledge of techniques for the analysis, design, maintenance and testing of software systems.

Total No. of Lectures –36

Lecture wise breakup		**Number of Lectures**
SECTION – A		
1	**Introduction:** Problems encountered during software development and their causes, Software life cycle. **Software Planning:** Software Planning: Objectives and Scope, Costing Estimation and Scheduling.	9

SECTION – B		
2	**Software Requirement Analysis:** Fault finding techniques, information flow, information structure, data base requirements, requirement analysis tools. **Software Design Process:** System design tools and techniques, Top down technique, structural programming; Data oriented design, design documentation and review.	9

SECTION – C		
3	**User Interface Design:** Design issues, Features of a modern GUI; Menus, scrolling, windows, icons, panels, error messages, etc. **Software Maintenance:** Maintainability, documentation to facilitate maintenance; Reverse engineering.	9
SECTION – D		
4	**Software Testing and Reliability:** Purpose of testing, unit testing, component testing, integration testing, system testing, testing tools, Regression testing, debugging and reliability.	9

Course Outcomes: After study of this subject the student	
1	Become able to know about various design techniques, issues and their analysis in the development of software systems.
2	Maintainability and various testing steps in the software design process.

Suggested / Reference Books:	
1	Software Engineering – A Practitioners Approach – R.S. Pressman, MCGraw Hill 1992.
2	Software Testing Techniques – Boris Beizer, Van Nostrand Reinhold, 1990
3	An Integrated Approach to Software Engineering, Pankaj
4	System Analysis and Design Methods – Wlutten, Bentley and Barlow; Galgotia Publications, 1996.

Course Name	**:**	**Operating System**
Course Code	**:**	**ECL-368**
Credits	**:**	**3**
L TP	**:**	**3-0-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

The objective of this course is to :

1. To have the basic understanding of fundamental concepts of operating system
2. To understand process management, device management, memory management and dick scheduling concepts.
3. To acquire knowledge about functioning of different operating systems such as Windows 8x/XP/2000, UNIX, LINUX etc.

Total No. of Lectures –36

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	**Introduction to Operating Systems**, Main Functions and characteristics of Operating Systems, Types of Operating Systems, System Calls **Process Management:** Process States, Process Control Block, Process Scheduling, CPU Scheduling, Resource allocation graph, Deadlocks: Deadlock Avoidance and Deadlock Handling	9
	SECTION - B	
2	**Process Synchronization**: Race Condition, Critical Section, Semaphores, Classical problems of synchronization, Monitors	9
	SECTION - C	
3	**Memory Management**: External fragmentation, Internal fragmentation, Compaction, Paging, Segmentation, Virtual memory, Demand paging. **Device Management:** Dedicated devices, shared devices, virtual devices, channels, I/O traffic controller, I/O scheduler, I/O Device handlers.	9

	SECTION - D	
4	**Disk Scheduling:** FCFS, SSTF, SCAN, C–SCAN, N–Stop Scan Introduction to Multiprocessor and Distributed Operating Systems **Case Studies:** Windows 8x/XP/2000, UNIX, LINUX to be discussed briefly.	9

Course Outcomes:	
1	Acquired knowledge about basics of operating system
2	Gained knowledge about design and functioning of different types of operating systems such as Windows 8x/XP/2000, UNIX, LINUX etc.

Suggested / Reference Books:	
1	Peter B. Galvin, A. Silberchatz: Operating System Concepts, Addison Wesley, 6th Edi., 2003. India.
2	A.S. Tenenbaum: Operating System: Design and Implementation PHI, 1989
3	Madnick and Donovan: Operating System, McGraw Hill, 1973.
4	P.B. Henson: Operating System Principles, Prentice Hall, 1973
5	P.B. Henson: Architecture of concurrent programs, Prentice Hall, 1977.
6	A.C. Shaw: Logic Design of operating System, Prentice Hall, 1974.
7	M.J. Bach: Design of UNIX Operating system, PHI, 1986.

Course Name	**:**	**MICRO CONTROLLERS**
Course Code	**:**	**ECL-365**
Credits	**:**	**4**
L T P	**:**	**3-0-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

	Lecture wise breakup	**Lectures**
	SECTION – A	
1	**Introduction: 8051 Microcontroller**; Comparison of Microprocessor and Microcontroller, Microcontroller and embedded processors, overview of 8085 families. **8051 Assembly Language Programming**: Introduction to 8051 Assembly programming, Assembling and running an 8051 program, Data types and Directives, 8051 flag bits and PSW register, Register banks and stack.	9
	SECTION - B	
3	**Jump loop and call instructions, I/O Port Programming**: Addressing modes and accessing memory using various addressing modes, Arithmetic instructions and programs, Logic instructions and programs, Single bit instructions and programming. Timer/Counter Programming in 8051.	10
	SECTION - C	
4	**Serial Communication**: 8051 connection to RS 232, 8051 serial communication programming. **Real World Interfacing:** LCD, ADC and sensors, stepper motor, keyboard, DAC and external memory.	9

	SECTION - D	
6	**Introduction to an Embedded System and its Design**: Introduction to ES & its applications, design parameters of an ES and its significance (with respect to all parameters), present trends in ES, Embedded System design life cycle, product specifications and hardware, software partitioning, Co–design. **Introduction to latest Microcontrollers such as ARM Processors and its applications.**	8

Suggested / Reference Books:	
1	. The 8051 Microcontroller and Embedded Systems by Ali Mazidi
2	An Embedded Software Primer, David E.Simon, Pearson Education.
3	Embedded System Design by Frank Vahid and Tony Givargus.

Course Name	**:**	**Digital System Design**
Course Code	**:**	**ECL–370**
Credits	**:**	**4**
L TP	**:**	**3-0-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

1. To make students aware about Real time Programming using VHDL.
2. To make students aware about different modelling styles.
2. To make students aware about importance of Test Bench.

Total No. of Lectures –36

	Lecture wise Breakup	**Number of Lectures**
	SECTION - A	
1	**INTRODUCTION:** Introduction to Computer aided design tools for digital systems. Hardware description languages; introduction to VHDL, data objects, classes and data types, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioural, data flow and structural models.	9
	SECTION – B	
2	**VHDL STATEMENTS**: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements, component declaration Types of Modelling: Structural Modelling, Behavioral Modelling, Data flow Modelling.	9
	SECTION – C	
3	**COMBINATION CIRCUIT DESIGN**: VHDL Models and Simulation as well as Test Bench of combinational circuits such as Multiplexers, De–multiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc. **SEQUENTIAL CIRCUITS DESIGN**: VHDL Models and Simulation of Sequential circuits, Shift Registers, Counters etc.	9

SECTION – D		
4	**DESIGN OF MICROCOMPUTER**: Architecture and test bench of a simple microcomputer system using VHDL. **DESIGN WITH CPLDs AND FPGAs**: Programmable logic devices: ROM, PLAs, PALs, CPLDs and FPGA. Design implementation using CPLDs and FPGAs.	9

Course Outcomes: Students who successfully complete the course will be able to:	
1	Understand different modelling styles of VHDL.
2	Do programming for Combinational & Sequential Circuits.
3	Write Test Bench for all digital components.

Suggested / Reference Books:	
1	. "A VHDL Primer": Bhasker; Prentice Hall 1995.
2	"Digital System Design using VHDL". Charles.H.Roth; PWS (1998).
3	Digital Design and Modelling with VHDL and Synthesis: KC Chang; IEEE Computer Society Press.
4	Fundamentals of Digital Logic with VHDL Design: Brown and Vranesic; TMH (2000).
5	"VHDL–Analysis & Modelling of Digital Systems" : Navabi Z; McGraw Hill.

SEMESTER – VII

S. No.	Course Code	Course Title	L	T	P	Credits
1.	ECL-453	Computer Architecture and Organization	3	1	0	4
2.	ECL412	Digital Signal Processing	3	1	1	5
3.		Elective – VII	4	0	0	4
4.		Elective – VIII	4	0	0	4
5.		Elective – IX	4	0	0	4
6.		General Elective*	4	0	0	4
	ECP-413	Seminar	0	0	2	2
		Total Credits:	22	2	3	27
List of Elective VII						
1.	ECL–451	Optical Communication	4	0	0	4
2.	ECL-460	Wireless Sensor Networks	4	0	0	
List of Elective VIII						
1.	ECL–411	Neural Network and Fuzzy Logic	4	0	0	4
2.	ECL–454	Image Processing	4	0	0	
3.	ECL–459	Fundamental of Nano Electronics	4	0	0	
List of Elective IX						
1.	ECL–452	Wireless Communication	4	0	0	4
2.	ECL–455	Cellular and Mobile Communication	4	0	0	
3.	ECL–456	Bio–sensors and MEMS	4	0	0	
4.	ECL–458	Radar System Engineering	4	0	0	

***Course relevant to the subject and to be decided by the BOC.**

Semester – VIII

S. No.	Course Code	Course Title	L	T	P	Credits
1.	**ECE-421**	**Industrial Training**	0	0	20	20
					Total Credits:	**20**

Course Name	**:**	**COMPUTER ARCHITECTURE AND ORGANIZATION**
Course Code	**:**	**ECL-453**
Credits	**:**	**4**
L TP	**:**	**3-1-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

At the end of this course, the student should be able to understand the

1. Hardware design including logic design, basic structure and behaviour of the various functional modules of the computer.
2. Basic organization and architecture of digital computers (CPU, memory, I/O, software).
3. Concepts that includes digital logic and microprogramming.
4. Various data transfer techniques in digital computer.
5. Processor performance improvement using parallelism.

Total No. of Lectures –36

	Lecture wise breakup	**Number of Lectures**
	SECTION – A	
1	Introduction to Computer Architecture: Basic computer organization, System buses, Instruction cycles, Instruction format, Instruction types, Addressing modes CPU Organization- Design specification of a simple CPU, Instruction fetching, Decoding & executing. Design of a simple ALU.	12
	SECTION – B	
2	Control Section: Design methods, Hardwired control & Micro programmed control approach Memory organization- Memory subsystem organization & interfacing, Types of memories- cache memory, interleaved, associative, virtual memory.	12

SECTION – C		
3	I/O Subsystem: I/O subsystem organization & interfacing, DMA &interrupts, I/O processors. Parallel processing: Trends in parallel processing, parallel processing mechanism, Flynn's taxonomy.	12
SECTION – D		
4	Serial vs parallel processing, Parallelism vs pipelining. Array processor, Multiprocessor systems-loosely coupled Multiprocessor & tightly coupled Multi processor.	12

Course Outcomes:	
1	A better understanding and utilization of digital computers.
2	An understanding of various memory units with their hierarchy design, involved in the working of a computer system
3	Understanding of various parallel, pipelining processor architectures.
4	Students will be able to design and understand the application of a computer systems.

Suggested / Reference Books:	
1	Comp. Architecture & Organization by John P. Hynes,Mc Graw Hill International
2	Computer System Architecture by Morin Mano, PHI
3	Computer Architecture & Parallel Processing, Faye A. Briggs, McGraw Hill International
4	Computer System Organization & Architecture, John D. Carpinelli, Addison Wesley
5	Computer Architecture & Organization by B. Govinderajalu (TMH), 2007.

Course Name	**:**	**DIGITAL SIGNAL PROCESSING**
Course Code	**:**	**ECL–412**
Credits	**:**	**5**
L TP	**:**	**3-1-1**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
At the end of this course, the student should be able to understand the key theoretical aspects of discrete-time signals and systems, their time domain and frequency domain analysis, and applications

Total No. of Lectures –44

	Lecture wise breakup	**Number of Lectures**
	SECTION – A	
1	**Introduction:** Limitations of analog signal processing, Advantages of digital signal processing and its applications, classification of discrete time sequences and systems, representation of signals, manipulation of discrete time signals, linear convolution, correlation and autocorrelation, Concepts of stability, causality, linearity, difference equations.	12
	SECTION – B	
2	**Z–transform:** Introduction, definition of Z-Transform, Region of convergence, properties of Z transform, evaluation of inverse Z– transforms by different methods. **Discrete Fourier Transform:** Introduction, Discrete Time Fourier Transform, Magnitude and Phase Spectra, Discrete Fourier Transform, computing inverse DFT by using a direct IDFT.	12

SECTION – C		
3	**Fast Fourier Transform**: Fast Fourier transform using decimation in time and decimation frequency algorithms, Goertzel algorithm. **Finite Impulse Response (FIR) filters:** Introduction, magnitude and phase response of digital filters, frequency response of linear phase FIR filters, Design methods for FIR filter, design of optimal linear phase transformation.	12
SECTION – D		
4	**Infinite Impulse Response (IIR) Filters:** Introduction, IIR filters design by derivatives, impulse invariant, bilinear transformation & Matched Z-Transformation method, Frequency transformation. **Finite Precision Effects:** Fixed point and Floating point representations, Effects of coefficient SECTIONization, Effect of round off noise in digital filters, Limit cycles.	12

Digital Signal Processing Lab	
	Hands-on experiments related to course contents using the following software: • MATLAB • Code Composer Studio

Course Outcomes: Students who successfully complete the course will be able to:	
1	Do the analysis of discrete time signals and systems.
2	Determine the frequency response, the z-transform of discrete-time systems and the discrete Fourier transform of discrete-time signals.
3	Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters.

Suggested / Reference Books:	
1	"Digital Signal Processing Principles, Algorithms and Application" John G Proakis, Dimtris G Manolakis 4th 2009.
2	"Digital Signal Processing" S. Salivahan, A Vallavaraj, Gnanpiya 1st 2008 Tata McGraw Hill.
3	"Discrete-Time Signal Processing" Alan V Oppenheim, Ronald W Schafer, John R Back 2nd 2008, Prentice Hall.
4	"Digital Signal Processing-A Computer Based Approach" S. K. Mitra 1st 2006 Tata McGraw Hill.
5	Jervis, Pearson Education India. 6. "Introduction to Digital Signal Processing" Johny R. Johnson PRACTICAL Design

Course Name	**:**	**OPTICAL COMMUNICATION**
Course Code	**:**	**ECL-451**
Credits	**:**	**4**
L TP	**:**	**4-0-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Total No. of Lectures –36

	Lecture wise breakup	Number of Lectures
	SECTION - A	
1	**INTRODUCTION** Evolution of fiber optic systems, Elements of optical fiber transmission links, Brief review of basic concepts and transmission characteristics of optical fibers. **POWER LAUNCHING AND COUPLING** Source of fiber power launching– source output pattern, power coupling calculations, equilibrium numerical aperture, LED coupling to single mode fiber, Lensing schemes for coupling improvement. Fiber to Fiber joints, Fiber splicing, Optical fiber connectors and couplers.	12
	SECTION – B	
2	**PHOTO DETECTOR** p–i–n photo detector, avalanche photo detector, photo detector noise, detector response time, photo diode materials. **POINT TO POINT OPTICAL LINK DESIGN** System considerations, Link power budget, Rise time budget, Line coding– NRZ, RZ, Optical Manchester and block codes.	12
	SECTION – C	
3	**WDM FIBER OPTIC NETWORKS** Overview, Time division and wave length division multiplexing in fiber optic networks, Add/ drop problem. Repeaters and amplifiers, Transmitter and receiver requirements in WDM networks. Semiconductor optical amplifiers and Erbium doped fiber amplifiers (EDFAs).	12

	SECTION – D	
4	**PASSIVE COMPONENTS, SWITCHES AND FUNCTIONAL MODULES OF FIBER OPTIC NETWORKS** Couplers/ Splitters, WDM multiplexers and demultiplexers, Filters: Fixed and tunable. Isolators, Circulators and attenuators, optical switches: Single and multistage switches. Basic principle of wavelength converters. Functional modules of Fiber optic networks like Add/ Drop multiplexers and optical cross connects with and without wavelength conversions.	12

Course Outcomes:

Students will be able to understand many physical phenomenon inside a fiber medium and able to learn how to use them in applications like sensors and telecommunication.

Suggested / Reference Books:	
1	*Djafar K. Mynbaev, Lowell L. Scheiner Fiber Optic Communication Technology, Pearson Education Asia*
2	*Keiser– Optical Fiber Communications, McGraw Hill*
3	*John M. Senior– Optical Fiber Communications: Principles and Practices PHI*
4	*Chai Yeh– Hand books of Fiber Optics 5. Govind P. Agrawal: Fiber Optic Communication Systems, John Willey Sons Inc. USA 6. Bishnu P. Pal: Guided Wave Optical Components & Devices, Elsevier Academic Press.*

Course Name	**:**	**Wireless Sensors Networks**
Course Code	**:**	**ECL-460**
Credits (L-T-P)	**:**	**4(4-0-0)**
Total Marks	**:**	**100**
Mid Semester Examination	**:**	**20% weightage**
End Semester Examination	**:**	**80% weightage**

Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
1. To make students aware about Sensor Networks and their parameters. 2. To make students aware about different protocols of WSN.

Total No. of Lectures –40

Lecture wise breakup		**Number of Lectures**
SECTION – A		
1	**Introduction to Wireless Sensor Networks:** Overview of Wireless Sensor Networks, Network Characteristics, Network Design Constraints and Challenges, Emerging technologies for wireless sensor networks, Advantages of sensor networks, Sensor network applications. **Network architectures and protocol stack:** Sensor Node architecture, Sensor node hardware overview, Controller, Memory, Communication device, Sensors and actuators, Power supply of sensor nodes, Energy consumption of Sensor nodes, Dynamic energy and power management on System level, Examples of Sensor nodes, Classifications of Wireless Sensor Networks, Optimization goals and figures of merit, QOS, Energy Efficiency, scalability, robustness, Gateway concepts, need for gateways	10

SECTION – B		
2	**Topology Control:** Location based routing protocols, Geographic Adaptive Fidelity (GAF), Geographic Random Forwarding (GeRaF), GEAR, SPAN, ASCENT. **Physical Layer**: Physical layer and transceiver design considerations in WSN's, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling.	10
SECTION – C		
3	**Physical layer and MAC protocols:** Fundamentals of (wireless) MAC protocols for WSN, classification of MAC protocols for Wireless Sensor Networks, Low Duty Cycle Protocols & Wakeup Concepts, S-MAC, T-MAC, D-MAC, Mediation Device Protocol, Wakeup Radio Concepts, Contention-Free Protocols	10
SECTION – D		
4	**Naming and addressing:** Use of addresses and names in (sensor) networks, Address management tasks, Uniqueness of addresses, Uniqueness of addresses, Address and name management in wireless sensor networks, Assignment of MAC addresses, Distributed assignment of locally unique addresses, Address assignment algorithm, Address selection and representation.	10

Course Outcomes: After study of this subject the student	
1	Will be familiar to different protocols in WSN.
2	Can understand the phenomena of energy saving protocol.
3	Will know the applications of WSN.

Suggested / Reference Books:	
1	Holger Karl & Andreas Willig, "Protocols & Architectures for Wireless Sensor Networks", John Wiley, 2005.
2	Feng Zhao & Leonidas J. Guibas, —Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3	Waltenegus Dargie and Christian Poellabauer, —Fundamentals of Wireless Sensor Networks – Theory and Practice‖ , John Wiley and Sons, first edition, 2010.
4	Jun Zheng and Abbas Jamalipour- wireless sensor networks -a networking Perspective, a john wiley & sons, inc., 2009.

Course Name	**:**	**NEURAL NETWORK& FUZZY LOGIC**
Course Code	**:**	**ECL-411**
Credits	**:**	**4**
L T P	**:**	**4-0-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

SECTION–A

Fundamentals of Neural Networks, History, Basic concepts of Neural networks, Model of and Artificial neuron, Basic neural network architectures characteristics of Neural networks, Introduction to various learning methods,

SECTION–B

Back propagation network–architecture, the perception model, model for multilayer perception, Backpropagation learning and applications. Basic Hop field model, Kehonen feature maps.

SECTION–C

Associative memory, Auto correlators, hetero correlators, Wang et al's multiple training encoding strategy, BAM, Associative memory for Real–coded pattern pairs and applications.

SECTION–D

Fuzzy set theory–Introduction, crisp sets, and fuzzy sets, crisp and fuzzy relations. Fuzzy Systems: Crisplogic, Predicate logic, fuzzy logic, fuzzy rule based system, Defuzzilication methods and applications.

Recommended Books:

1. Neural networks, fuzzy logic and Genetic Algorithm by S. Rajesekaran, G.A. Vijayalakshmi Pai,PHI
2. Neural Networks & Fuzzy Logic by Bart Kosko.
3. Neural Computing Theory & Practice by P.D. Wasserman (ANZA PUB)

Course Name	**:**	**IMAGE PROCESSING**
Course Code	**:**	**ECL-454**
Credits	**:**	**4**
L TP	**:**	**4-0-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

- To introduce students about the scope and applications of image processing in a corporate world.
- A discussion on basics of image processing to build enthusiasm and interest of students to handle some practical problems.
- To introduce students with practical tools related to image processing.

Total No. of Lectures –55

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	Introduction to Electronic Image Processing: Historical background, visual perception, image formation, sampling & Quantization & application of image Processing	5
2	Transforms used in Electronic Image Processing: Review of 1–D & 2–D Fourier Transforms, Discrete Fourier Transforms & other image transforms.	5
3	Image Enhancement by Point operation: An overview of point processing, constants & non– linear operations between image and histogram techniques	8
	SECTION - B	
4	Spatial Filtering & Fourier frequency Method: Noise in image, Spatial & Special Frequency Filtering, image restoration.	8
5	Non–linear image processing techniques: Non–linear Spatial/Mean/Adaptive & Homo–morphic filters	6

SECTION - C		
6	Color Image Processing: Color models, examples of color image processing, Pseudo–coloring & color displays.	8
7	Image segmentation & Representation: Image Thresh–holding, Edge/Line & point direction, Region based segmentation & Image representation.	8
SECTION - D		
8	Introduction to Morphological filters & Image Compression.	7

Course Outcomes:	
	At the end of this course the students should be able to understand basics of image processing, scope, tools and its real time applications. This course should build enough confidence among the students to handle some practical problems.

Suggested / Reference Books:	
1	Digital Image Processing by Rafael C. Gonzale & Richard E. Woods, Pearson Education Asia (2nd Edition 2002).
2	Fundamentals of Digital Image Processing by A.K. Jain, 1989, Prentice Hall, Englewood Cliffs, N.J.

Course Name	**:**	**Fundamental of Nano Electronics**
Course Code	**:**	**ECL–459**
Credits	**:**	**4**
L TP	**:**	**4-0-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
At the end of this course, the student should be able to understand the various aspects of nano-technology and the processes involved in making nano-components and material.

Total No. of Lectures –48

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	**Introduction to the practice and discipline of nanotechnology** (a) The Nanoscale Dimension and paradigm (b) The Top Down and Bottom Up Approach (c) Nanotechnology Potential Semiconductors (a) Moore's Law, history 1950-2025 (b) Molecular electronics as post-silicon computation paradigm (c) Beyond Moore	
	SECTION - B	
2	**Basic Nanotechnology Science** (a) Overview of Physics Fundamentals for nanotechnology (b) Overview of Chemistry Fundamentals of nanotechnology (c) Self Assembly and Overview of Complex Adaptive System (d) Overview of Supramolecular chemistry fundamentals Quantum Computing and devices (a) Quantum dots, (b) Quantum Wires (c) Quantum Wells	

	SECTION - C	
3	**Future Requirements for developments in nanotechnology** (a) Overview of Kondo Effect and Coulomb Blockade (b) Operating principle of single electron transistor (c) Molecular Manufacturing (d) Fabrication Techniques for Nanostructures (f) Drexler-Smalley debate- realistic projections **Carbon Nanotube Technologies (CNT)** (a) From graphite to buckyballs to CNT (b) Multi walled Nanotube (c) Fabricating carbon nanotubes and nano-wall structures (d) Key applications of CNT and MWNT	12
	SECTION - D	
4	Nanomaterials in consumer market (a) Electronics, photonics and NEMS (b) Thin Film applications (c) Nano-bio and nano medicine Challenges to nanotechnology (a) Skilled and educated workforce (b) Public and private investment in R&D (c) Materials risks, e.g. carbon fullerene and CNT Waste	12

Course Outcomes:	
	Students who successfully complete the course will be able to understand the basic science behind nanotechnology, applications and future scope of nanotechnology.

Suggested / Reference Books:	
1	Nanotechnology: A Gentle Introduction to Next Big Idea: Mark Ratner, Daniel Ratner, Prentice Hall.
2	Nanotechnology De Mystified- A Self Teaching Guide: Linda Williams, Dr. Wade Adams, McGraw Professional.
3	Fundamentals of Nanotechnology: Gabor L. Hornyak, John J. Moore, H.F. Tibbals, Joydeep Dutta, Taylor and Francis.
4	Fundamentals of Nanoelectronics: George W. Hanson, Pearson.
5	Nanotechnology: Lynn E. Foster, Pearson.

Course Name	**:**	**Wireless Communication**
Course Code	**:**	**ECL-452**
Credits	**:**	**4**
L TP	**:**	**4-0-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:

a) To study the concept of mobile radio propagation, cellular system design.
b) To know about the capacity enhancement factors of cellular system i.e. multiple access techniques.
c) To know the evolution of the 2G, 3G and 4G mobile technologies.
d) To understand mobile technologies like GSM and CDMA.

Total No. of Lectures –36

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	**Introduction:** Mobile radio System around the world, Examples of Wireless Communication system, Paging System, Cordless Telephone Systems, Cellular Telephone System, and Comparison of common Wireless Communication System. **Digital Communication Through Fading Multipath Channels**: Fading channel and their characteristics, Channel modeling, Digital signaling over a frequency non selective slowly fading channel, Frequency selective slowly fading channel, Calculation of error probabilities, Tapped Delay line model, The RAKE demodulator, Performance, Concept of Diversity branches and signal paths, Combining methods, Selective diversity combining, Pre–detection and post detection combining, Switched combining, Maximal radio combining, Equal Gai combining.	12
	SECTION – B	
2	**Multiple Access techniques for Wireless Communication:** Introduction, Frequency division, Multiple Access(FDMA), Time division multiple Access(TDMA), Spread Spectrum Multiple Access, Space division Multiple Access, Packet radio Protocols, Pure ALOHA, Slotted ALOHA, Capacity of Cellular System.	12

	SECTION – C	
3	**Wireless Networking:** Introduction, Difference between wireless & Fixed Telephone Networks, Development of Wireless Networks, Traffic Routing In Wireless network, Wireless data Services, Common channel Signaling, Broadband ISDN & ATM, Signaling System No.7(SS–7), Personal communication Services/Networks, Protocols for Network Access, Network Databases. **Wireless Systems and Standards:** AMPS and ETACS, SECTIONed States digital cellular (IS–54 & IS136), Global System for Mobile(GSM); Services, Features, system architecture and channel types, Frame structure for GSM, Speech processing in GSM, CDMA digital standards(IS 95); Frequency and channel specifications, Forward CDMA Channel, Reverse CDMA channel, CT2 standard for cordless Telephones, Personal Access Communication System, Pacific Digital Cellular, Personal Handy phone System, PCS and ISM bands, Wireless Cable Television.	12
	SECTION – D	
4	Components and working of WLAN, transmission media forWLAN, Modulation Techniques for WLAN(DSSS,FHSS), IEEE802.11 standards and protocols for WLAN (MACA,MACAW), Mobile Network and Transport Layer, Mobile IP, Mobile TCP, trafficrouting in wireless networks, wireless ATM, Wireless Local Loop(WLL), WLL Architecture, WLLTechnologies and frequency spectrum. **Future Trends:** Bluetooth technology, 4G Mobile techniques, Wi–Fi Technology.	12

Course Outcomes: After successful completion of the course student will be able to	
1	Know about the multi path propagation losses and their remedies.
2	Know modern multiple access schemes, the concept of frequency reuse, channel assignment strategies.
3	Understand evolution of mobile communication generations 2G, 2.5G, and 3G with their characteristics and limitations.
4	Understand GSM, CDMA and W-LAN concepts, their architecture, frame structure, system capacity and services.

Suggested / Reference Books:	
1	Wireless Communications, Principles, and Practice by Theodore S. Rappaport, Third Indian Reprint Pearson Education Asia, 2003.
2	Mobile and Personal Communication Systems and Services by Raj Pandya, Prentice Hall of India, 2001.

Course Name	**:**	**Cellular and Mobile Communication**
Course Code	**:**	**ECL-455**
Credits	**:**	**4**
L TP	**:**	**4-0-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
At the end of this course, the student should be able to understand the elements of cellular system and design of mobile radio system.

Total No. of Lectures –36

Lecture wise breakup		**Number of Lectures**
SECTION - A		
1	**Introduction to Cellular Mobile Systems:** A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, analog& digital cellular systems. **Cellular Wireless Communication Systems:** Second generation cellular systems: GSM specifications and Air Interface – specifications of various SECTIONs, 2.5 G systems: GPRS/EDGE specifications and features. 3G Systems: UMTS & CDMA 2000 standards and specifications.	12

	SECTION – B	
2	Elements of Cellular Radio Systems Design: General description of the problem, concept of frequency reuse channels, co–channel interference reduction factor, desired C/I from a normal case in an Omni directional antenna system, cell splitting, consideration of the components of cellular systems. Interference: Introduction to co–channel interference, real time co–channel interference, co–channel measurement design of antenna system, antenna parameter and their effects, diversity receiver in co–channel interference – different types. Cell Coverage for Signal & Traffic: General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model – characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation.	12
	SECTION – C	
3	Cell Site Antennas and Mobile Antennas: Characteristics, antenna at cell site, mobile antennas, Frequency Management and Channel Assignment, Frequency management, fixed channel assignment, non–fixed channel assignment, traffic& channel assignment.	12
	SECTION – D	
4	Hand Off, Dropped Calls: Why hand off, types of handoff and their characteristics, dropped call rates & their evaluation. Optional Techniques: Parameters, coverage hole filler, leaky feeders, cell splitting and small cells, narrow beam concept.	12

Course Outcomes:	
	After successful completion of the course student will be able to understand cellular mobile system design, technology and mobile radio environment.

Suggested / Reference Books:	
1	Mobile Cellular Telecommunications; 2nd Ed., William, C Y Lee McGraw Hill.
2	Wireless and Digital Communications; Dr. Kamilo Feher (PHI).
3	Wireless Communication, Principles & Practice: T.S. Rappaport, PHI, 2001.

Course Name	**:**	**Bio-sensors and MEMS**
Course Code	**:**	ECL-456
Credits	**:**	4
L TP	**:**	4-0-0
Course Objectives:		
To study the fundamentals of Bio Sensors and MEMS		

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Total No. of Lectures –36

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	**Overview of biosensors and their electrochemistry:** Molecular reorganization: enzymes, Antibodies and DNA, Modification of bio recognition molecules for Selectivity and sensitivity Fundamentals of surfaces and interfaces. **Bioinstrumentation and bioelectronics devices:** Principles of potentiometry and potentiometric biosensors, principles of amperometry and amperometric biosensors, Optical Biosensors based on Fiber optics.	12
	SECTION – B	
2	**MEMS Technology:** Introduction to MEMS, MEMS design and fabrication technology: Lithography, Etching, MEMS material, Metals, Semiconductors, Ceramics and Organic Materials, bulk micromachining, Surface micromachining.	12
	SECTION – C	
3	**RF MEMS:** Introduction to static and dynamic Beam Analysis, Electromagnetic modeling concept, MEMS Switches & Micro relays, Inductor &Capacitors, MEMS phase shifter, Antenna, Applications.	12

SECTION – D		
4	**BioMEMS:** Bio/Nano Technology, Biomass, Mendalian genetics, Genomics and proteomics, biosensor arrays; electronic nose and electronic tongue, DNA Transistor, Applications.	12

Course Outcomes: After successful completion of the course student will be able to understand various types of Bio-sensors and MEMS as well as their applications.

Suggested / Reference Books:

1	P Buck, William E. Hatfield (1990), "Biosensors Technology" Marcel Dekker
2	Vijay K Varadan, K J .Vinoy and K A Jose (2004), "RF MEMS and Applications" Wiley–Vch UK.
3	Baltes H, Brand (2004), "Enabling Technology for MEMS and Nano Devices" Wiley–Vch.

Course Name	**:**	**Radar System Engineering**
Course Code	**:**	**ECL-458**
Credits	**:**	**4**
L TP	**:**	**4-0-0**

Total Marks: 100
Mid Semester Examination: 20% weightage
End Semester Examination: 80% weightage

Instructions for the Paper Setters:
Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Course Objectives:
To study the fundamentals of Radar System and technology.

Total No. of Lectures –36

	Lecture wise breakup	**Number of Lectures**
	SECTION - A	
1	**Introduction:** Radar equation, block diagram, operation and application. **Radar Equation:** Various parameters of radar equation. **CW and FM CW Radar:** Doppler effect. CW radar. FM CW radar. Multiple frequency CW Radar. **MTI and Pulse Doppler Radar:** MTI radar, Delay lines, cancellers, Pulse doppler radar, Noncoherent MTI radar, AMTI radar.	12
	SECTION – B	
2	**Tracking Radar:** Sequential loping, conical scan, Monopulse, Tracking in range and doppler, Acquisition. **Radar Transmitters, Antennas and Receivers:** Hard tube and pulse modulators. Types of Radar antennas, Duplexers, Displays. **Electronic Scanning Radar:** Principle of phased array for electronic scanning, Advantages and capabilities of electronic scanning, block diagram of a electronic scanning system and its operation.	12

SECTION – C		
3	**Navigational Aids:** Loaran, Radio range Aircraft, Landing Systems – instruments landing system and Ground controlled approach, Radio Direction Finding, Satellite based navigation system.	12
SECTION – D		
4	**Electronic Warfare:** Electron Reconnaissance (ER), Electronic Counter Measures (ECM),Electronic Counter Counter Measures (ECCM) – different techniques.	12
Course Outcomes:		
	After successful completion of the course student will be able to understand various types of Radar and their operations as well as applications.	

Suggested / Reference Books:	
1	Introduction to Radar System by M.I. Skolnik, McGraw Hill.
2	Electronic and Radio Engg.byF.E. Terman, McGraw Hill.
3	Radar Engg. Hand Book by M.I. Skolnik, McGraw Hill.
4	Radar Systems and Radio Aids by Sen& Bhattacharya, McGraw Hill. to Navigation

ECP–413: SEMINAR

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Students are required to give a seminar/presentation along with report on latest topics related to their degree of specialization.