

University of Mumbai



No. AAMS(UG)/ 25 of 2022-23

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges, Directors of the Recognized Institutions in Faculty of Science & Technology is invited to this office circular No. UG/56 of 2021 dated 21st January, 2021 relating the revised syllabus (Rev-2019 'C' Scheme) for the B.E. in Electronics and Telecommunication Engineering (Sem. III & IV).

They are hereby informed that the recommendations made by the Ad-hoc Board of Studies in Electronics and Telecommunication Engineering at its meeting held on 14th November, 2021 and subsequently passed by the Board of Deans at its meeting held on 27th December 2021 vide item No. 6.17 have been accepted by the Academic Council at its meeting held on 28th December, 2021 vide item No. 6. 17 and that in accordance therewith, the reduced syllabus for B.E. (Electronics and Telecommunication Engineering) (Rev-2019 'C' Scheme for Direct Second Year (Sem.III) as Direct Second Year (DSE) students admission is delayed by the six months, due to COVID-19 situation, has been brought into force with effect from the academic year 2021-22 only. (The same is available on the University's website www.mu.ac.in).

MUMBAI – 400 032

5th May, 2022

To

(Sudhir S. Puranik)
REGISTRAR

The Principals of the Affiliated Colleges, and Directors of the Recognized Institutions in Faculty of Science & Technology.

A.C/6.17/28/12/2021

No. AAMS(UG)/25 -A of 2022-23

9th May, 2022

Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Board of Studies Electronics and Telecommunication Engineering,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Director, Department of Information & Communication Technology,
- 6) The Co-ordinator, MKCL.

(Sudhir S. Puranik)
REGISTRAR

Copy for information and necessary action :-

1. The Deputy Registrar, College Affiliations & Development Department (CAD),
2. College Teachers Approval Unit (CTA),
3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),
4. The Deputy Registrar, Academic Appointments & Quality Assurance (AAQA)
5. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),
6. The Deputy Registrar, Executive Authorities Section (EA)
He is requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to the above circular.
7. The Deputy Registrar, PRO, Fort, (Publication Section),
8. The Deputy Registrar, Special Cell,
9. The Deputy Registrar, Fort Administration Department (FAD) Record Section,
10. The Deputy Registrar, Vidyanagari Administration Department (VAD),

Copy for information :-

1. The Director, Dept. of Information and Communication Technology (DICT), Vidyanagari,
He is requested to upload the Circular University Website
2. The Director of Department of Student Development (DSD),
3. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,
4. All Deputy Registrar, Examination House,
5. The Deputy Registrars, Finance & Accounts Section,
6. The Assistant Registrar, Administrative sub-Campus Thane,
7. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,
8. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,
9. P.A to Hon'ble Vice-Chancellor,
10. P.A to Pro-Vice-Chancellor,
11. P.A to Registrar,
12. P.A to All Deans of all Faculties,
13. P.A to Finance & Account Officers, (F & A.O),
14. P.A to Director, Board of Examinations and Evaluation,
15. P.A to Director, Innovation, Incubation and Linkages,
16. P.A to Director, Department of Lifelong Learning and Extension (DLLE),
17. The Receptionist,
18. The Telephone Operator,

Copy with compliments for information to :-

19. The Secretary, MUASA
20. The Secretary, BUCTU.

UNIVERSITY OF MUMBAI



**Bachelor of Engineering
(Electronics and Telecommunication Engineering)**

**Direct Second Year (Sem. III) Admitted Students for the
current Academic Year 2021-22 Only due to Covid
Pandemic**

(REV- 2019 'C' Scheme) from Academic Year 2019 – 20

**Under
FACULTY OF SCIENCE & TECHNOLOGY**

**Program Structure for Second Year Engineering Semester
III & IV
UNIVERSITY OF MUMBAI
(With Effect from 2021-2022)
Semester III**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ECC301	Engineering Mathematics-III	3	--	1*	3	--	1	4
ECC302	Electronic Devices & Circuits	3	--	--	3	--	--	3
ECC303	Digital System Design	3	--	--	3	--	--	3
ECC304	Network Theory	3	--	1	3	--	1	4
ECC305	Electronic Instrumentation & Control Systems	3	--	--	3	--	--	3
ECL301	Electronic Devices & Circuits Lab	--	2	--	--	1	--	1
ECL302	Digital System Design Lab	--	2	--	--	1	--	1
ECL303	Electronic Instrumentation & Control Systems Lab	--	2	--	--	1	--	1
ECL304	Skill Lab: C++ and Java Programming	--	4	--	--	2	--	2
ECM301	Mini Project 1A	--	4 ^{\$}	--	--	2	--	2
Total		15	14	2	15	07	2	24

* Should be conducted batch wise.

\$ Indicates work load of a learner (Not Faculty) for Mini Project 1A. Faculty Load: 1 hour per week per four groups.

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. & oral	Total
		Internal Assessment			End Sem. Exam	Exam. Duration (in Hrs)			
		Test 1	Test 2	Avg.					
ECC301	Engineering Mathematics-III	20	20	20	80	3	25	--	125
ECC302	Electronic Devices & Circuits	20	20	20	80	3	--	--	100
ECC303	Digital System Design	20	20	20	80	3	--	--	100
ECC304	Network Theory	20	20	20	80	3	25	--	125
ECC305	Electronic Instrumentation & Control Systems	20	20	20	80	3	--	--	100
ECL301	Electronic Devices & Circuits Lab	--	--	--	--	--	25	25	50
ECL302	Digital System Design Lab	--	--	--	--	--	25	--	25
ECL303	Electronic Instrumentation & Control Systems Lab	--	--	--	--	--	25	--	25
ECL304	Skill Lab: C++ and Java Programming	--	--	--	--	--	25	25	50
ECM301	Mini Project 1A	--	--	--	--	--	25	25	50
Total		--	--	100	400	--	175	75	750

ECC301 Engineering Mathematics-III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	TW/Pract	Tut.	Total
ECC301	Engineering Mathematics-III	03	-	01*	03	-	01	04

Course Code	Course Name	Examination Scheme								
		Theory					Exam Duration (in Hrs.)	Term Work	Pract & Oral	Total
		Internal Assessment			End Sem Exam					
		Test1	Test2	Avg of Test 1 & 2						
ECC301	Engineering Mathematics-III	20	20	20	80	03	25	-	125	

* Should be conducted batch wise.

Pre-requisite:

1. FEC101-Engineering Mathematics-I
2. FEC201-Engineering Mathematics-II
3. Scalar and Vector Product: Scalar and vector product of three and four vectors

Course Objectives: The course is aimed

1. To learn the Laplace Transform, Inverse Laplace Transform of various functions and its applications.
2. To understand the concept of Fourier Series, its complex form and enhance the problem solving skill.
3. To understand the concept of complex variables, C-R equations, harmonic functions and its conjugate and mapping in complex plane.
4. To understand the basics of Linear Algebra.
5. To use concepts of vector calculus to analyze and model engineering problems.

Course Outcomes: After successful completion of course student will be able to:

1. Understand the concept of Laplace transform and its application to solve the real integrals in engineering problems.
2. Understand the concept of inverse Laplace transform of various functions and its applications in engineering problems.
3. Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
4. Understand complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic function.
5. Use matrix algebra to solve the engineering problems.
6. Apply the concepts of vector calculus in real life problems.

Module	Detailed Contents	Hrs.
01	Module: Laplace Transform Definition of Laplace transform, Condition of Existence of Laplace transform. Laplace Transform (L) of Standard Functions like e^{at}, $\sin(at)$, $\cos(at)$, $\sinh(at)$, $\cosh(at)$ and $t^n, n \geq 0$. Properties of Laplace Transform: Linearity, First Shifting theorem, Second Shifting Theorem, change of scale Property, multiplication by t, Division by t, Laplace Transform of derivatives and integrals (Properties without proof). Evaluation of integrals by using Laplace Transformation. Self-learning Topics: Heaviside's Unit Step function, Laplace Transform of Periodic functions, Dirac Delta Function.	7
02	Module: Inverse Laplace Transform 2.1 Inverse Laplace Transform, Linearity property, use of standard formulae to find inverse Laplace Transform, finding Inverse Laplace transform using derivatives. 2.2 Partial fractions method to find inverse Laplace transform. 2.3 Inverse Laplace transform using Convolution theorem (without proof). Self-learning Topics: Applications to solve initial and boundary value problems involving ordinary differential equations.	6
03	Module: Fourier Series: 3.1 Dirichlet's conditions, Definition of Fourier series and Parseval's Identity (without proof). 3.2 Fourier series of periodic function with period 2π and $2l$. 3.3 Fourier series of even and odd functions. 3.4 Half range Sine and Cosine Series. Self-learning Topics: Complex form of Fourier Series, Orthogonal and orthonormal set of functions. Fourier Transform.	7
04	Module: Complex Variables: 4.1 Function $f(z)$ of complex variable, limit, continuity and differentiability of $f(z)$ Analytic function, necessary and sufficient conditions for $f(z)$ to be analytic (without proof). 4.2 Cauchy-Riemann equations in cartesian coordinates (without proof). 4.3 Milne-Thomson method to determine analytic function $f(z)$ when real part (u) or Imaginary part (v) or its combination ($u+v$ or $u-v$) is given. 4.4 Harmonic function, Harmonic conjugate and orthogonal trajectories Self-learning Topics: Conformal mapping, linear, bilinear mapping, cross ratio, fixed points and standard transformations.	7
05	Module: Linear Algebra: Matrix Theory 5.1 Characteristic equation, Eigen values and Eigen vectors, Example based on properties of Eigen values and Eigen vectors. (Without Proof). 5.2 Cayley-Hamilton theorem (Without proof), Examples based on verification of Cayley-Hamilton theorem and compute inverse of Matrix. 5.3 Similarity of matrices, Diagonalization of matrices. Functions of square matrix Self-learning Topics: Application of Matrix Theory in machine learning and google page rank algorithms, derogatory and non-derogatory matrices.	6
06	Module: Vector Differentiation and Integral 6.1 Vector differentiation: Basics of Gradient, Divergence and Curl (Without Proof). 6.2 Properties of vector field: Solenoidal and irrotational (conservative) vector	6

fields. 6.3 Vector integral: Line Integral, Green's theorem in a plane (Without Proof), Stokes' theorem (Without Proof) only evaluation. Self-learning Topics: Gauss' divergence Theorem and applications of Vector calculus.	
Total	39

References:

1. Advanced engineering mathematics, H.K. Das, S . Chand, Publications
2. Higher Engineering Mathematics, B. V. Ramana, Tata Mc-Graw Hill Publication
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication
4. Advanced Engineering Mathematics, Wylie and Barret, Tata Mc-Graw Hill.
5. Theory and Problems of Fourier Analysis with applications to BVP, Murray Spiegel, Schaum's Outline Series
6. Vector Analysis Murry R. Spiegel, Schaum's outline series, Mc-Graw Hill Publication
7. Beginning Linear Algebra, Seymour Lipschutz, Schaum's outline series, Mc-Graw Hill Publication
8. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication

Term Work:

General Instructions:

1. Batch wise tutorials are to be conducted. The number of students per batch should be as per University pattern for practicals.
2. Students must be encouraged to write at least 6 class tutorials on entire syllabus.
3. A group of 4-6 students should be assigned a self-learning topic. Students should prepare a presentation/problem solving of 10-15 minutes. This should be considered as mini project in Engineering mathematics. This project should be graded for 10 marks depending on the performance of the students.

The distribution of Term Work marks will be as follows –

1. Attendance (Theory and Tutorial)	05 marks
2. Class Tutorials on entire syllabus	10 marks
3. Mini project	10 marks

Internal Assessment Test (20-Marks):

Assessment consists of two class tests of 20 marks each. The first-class test (Internal Assessment I) is to be conducted when approx. 40% syllabus is completed and second class test (Internal Assessment II) will be based on remaining contents (approximately 40% syllabus but excluding contents covered in Test I). Duration of each test shall be one hour.

End Semester Theory Examination (80-Marks):

Weightage to each of the modules in end-semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total 06 questions, each carrying 20 marks.
2. Question No: 01 will be compulsory and based on entire syllabus wherein 4 to 5 sub- questions will be asked.
3. Remaining questions will be mixed in nature and randomly selected from all the modules.
4. Weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
5. Total 04 questions need to be solved.

ECC302 - Electronic Devices & Circuits

Subject Code	Subject Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECC302	Electronic Devices & Circuits	3	-	--	3	--	--	3

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical and Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. Of Test 1 and Test 2					
ECC302	Electronic Devices & Circuits	20	20	20	80	--	--	--	100

Course pre-requisite:

FEC:102 - Engineering Physics-I
 FEC:201 - Engineering Physics-II
 FEC:105 - Basic Electrical Engineering

Course Objectives:

1. To explain functionality different electronic devices.
2. To perform DC and AC analysis of small signal amplifier circuits.
3. To analyze frequency response of small signal amplifiers.
4. To compare small signal and large signal amplifiers.
5. To explain working of differential amplifiers and it's applications in Operational Amplifiers

Course Outcome:

After successful completion of the course student will be able to :-

1. Know functionality and applications of various electronic devices.
2. Explain working of various electronics devices with the help of V-I characteristics.
3. Derive expressions for performance parameters of BJT and MOSFET circuits.
4. Evaluate performance of Electronic circuits (BJT and MOSFET based).
5. Select appropriate circuit for given application.
6. Design electronic circuit (BJT, MOSFET based) circuits for given specifications.

Module No.	Unit No.	Topics	Hrs.
1.0		Small Signal Amplifiers	06
	1.1	Concept of AC load line and Amplification, Small signal analysis (Z_i , Z_o , A_v and A_i) of CE amplifier using hybrid pi model.	
	1.2	Small signal analysis (Z_i , Z_o , A_v) of CS (for E-MOSFET) amplifiers.	
	1.3	Introduction to multistage amplifiers. (Concept, advantages & disadvantages)	
2.0		Frequency response of Small signal Amplifiers:	08
	2.1	Effects of coupling, bypass capacitors and parasitic capacitors on frequency response of single stage amplifier, Miller effect and Miller capacitance.	
	2.2	High and low frequency analysis of CE amplifier.	
	2.3	High and low frequency analysis of CS(E-MOSFET) amplifier.	
3.0		Power Amplifiers and Differential Amplifiers	06
	3.1	Classification of Power Amplifiers, analysis of Class A transformer coupled power amplifier	
	3.2	E-MOSFET Differential Amplifier, DC transfer characteristics, operation with common mode signal and differential mode signal	
	3.3	Differential and common mode gain, CMRR, differential and common mode Input impedance	
		Total	20

Text books:

1. D. A. Neamen, "Electronic Circuit Analysis and Design," Tata McGraw Hill, 2nd Edition.
2. A. S. Sedra, K. C. Smith, and A. N. Chandorkar, "Microelectronic Circuits Theory and Applications," International Version, OXFORD International Students, 6th Edition
3. Franco, Sergio. Design with operational amplifiers and analog integrated circuits. Vol. 1988. New York: McGraw-Hill, 2002.

References:

1. Boylestad and Nashelesky, "Electronic Devices and Circuits Theory," Pearson Education, 11th Edition.
2. A. K. Maini, "Electronic Devices and Circuits," Wiley.
3. T. L. Floyd, "Electronic Devices," Prentice Hall, 9th Edition, 2012.
4. S. Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits," Tata Mc-Graw Hill, 3rd Edition
5. Bell, David A. Electronic devices and circuits. Prentice-Hall of India, 1999.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the tests will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
3. Question No.1 will be compulsory and based on entire syllabus.
4. Remaining question (Q.2 to Q.6) will be selected from all the modules.

ECC303 - Digital System Design

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECC303	Digital System Design	02	--	--	02	--	--	02

Course Code	Course Name	Examination Scheme							
		Theory Marks				Exam Duration (Hrs.)	Term Work	Practical and Oral	Total
		Internal Assessment			End Sem. Exam.				
		Test1	Test2	Avg.					
ECC303	Digital System Design	20	20	20	80	03	--	--	100

Course Pre-requisite:

FEC105 – Basic Electrical Engineering

Course Objectives:

1. To understand number system representations and their inter-conversions used in digital electronic circuits.
2. To analyze digital logic processes and to implement logical operations using various combinational logic circuits.
3. To analyze, design and implement logical operations using various sequential logic circuits.
4. To study the characteristics of memory and their classification.
5. To learn basic concepts in VHDL and implement combinational and sequential circuits using VHDL.

Course Outcomes:

After successful completion of the course student will be able to:

1. Understand types of digital logic, digital circuits and logic families.
2. Analyze, design and implement combinational logic circuits.
3. Analyze, design and implement sequential logic circuits.
4. Develop a digital logic and apply it to solve real life problems.
5. Classify different types of memories and PLDs.
6. Simulate and implement basic combinational and sequential circuits using VHDL/Verilog.

	Unit No.	Topics	Hrs.
1.0		Number system & Logic Gates	06
	1.1	Review of Binary, Octal and Hexadecimal Number Systems, their inter-conversion, Binary code, Gray code and BCD code, Binary Arithmetic, Addition, Subtraction using 1's and 2's	04
	1.2	Digital logic gates, Universal gates, Realization using NAND and NOR gates, Boolean Algebra, De Morgan's Theorem	02
2.0		Combinational & Sequential Logic Circuits	11
	2.1	SOP and POS representation, K-Map up to four variables and Quine-McClusky method for minimization of logic expressions	04
	2.2	Arithmetic Circuits: Half adder, Full adder, Half Subtractor, Full Subtractor, Carry Look ahead adder and BCD adder, Magnitude Comparator	04
	2.3	Flip flops: RS, JK, Master slave flip flops; T & D flip flops with, Conversion of flip flops, Registers: SISO, SIPO, PISO, PIPO.	03
3.0		Different Types of Memories and Programmable Logic Devices, Introduction to VHDL	03
	3.1	Introduction: Programmable Logic Devices (PLD), Programmable Logic Array (PLA), Programmable Array Logic (PAL)	01
	3.2	Basics of VHDL/Verilog Programming, Design and implementation of adder, subtractor, multiplexer and flip flop using VHDL/Verilog	02
		Total	20

Suggested list of experiments:

1. Simplification of Boolean functions.
2. Design AND, OR, NOT, EXOR, EXNOR gates using Universal gates: NAND and NOR.
3. Implement Half adder, Full adder, Half subtractor and Full subtractor circuits.
4. Verify truth table of different types of flip flops.
5. Flip flop conversions JK to D, JK to T and D to TFF.
6. Design asynchronous/synchronous MOD N counter using IC7490.
7. Write VHDL/Verilog simulation code for different logic gates.

Term Work:

At least 05 experiments covering the entire syllabus must be given “**Batch Wise**”. Teacher should refer the suggested list of experiments and can design additional experiments to acquire practical design skills. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting and innovative

Text Books:

1. John F. Wakerly, “Digital Design Principles and Practices”, Pearson Education, Fifth Edition (2018).
2. Morris Mano, Michael D. Ciletti, “Digital Design”, Pearson Education, Fifth Edition (2013).
3. R. P. Jain, “Modern Digital Electronics”, Tata McGraw Hill Education, Fourth Edition (2010).
4. A. Anand Kumar, “Fundamentals of Digital Circuits”, PHI, Fourth Edition (2016).
5. Volnei A. Pedroni, “Digital Electronics and Design with VHDL” Morgan Kaufmann Publisher, First Edition (2008).
6. Stephen Brown & Zvonko Vranesic, “Fundamentals of Digital Logic with Verilog Design”, Third Edition, MGH (2014).

Reference Books:

1. Thomas L. Floyd, “Digital Fundamentals”, Pearson Prentice Hall, Eleventh Global Edition (2015).
2. Mandal, “Digital Electronics Principles and Applications”, McGraw Hill Education, First Edition (2010).
3. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss “Digital Systems Principles and Applications”, Ninth Edition, PHI (2009).
4. Donald P. Leach / Albert Paul Malvino/Gautam Saha, “Digital Principles and Applications”, The McGraw Hill, Eight Edition (2015).
5. Stephen Brown & Zvonko Vranesic, “Fundamentals of Digital Logic Design with VHDL”, Second Edition, TMH (2009).
6. J. Bhasker, “A Verilog HDL Primer”, Star Galaxy Press, Third Edition (1997).

NPTEL / Swayam Course:

1. Course: Digital Circuits By Prof. Santanu Chattopadhyay (IIT Kharagpur);

Internal Assessment (20-Marks):

Internal Assessment (IA) consists of two class tests of 20 marks each. IA-1 is to be conducted on approximately 40% of the syllabus completed and IA-2 will be based on remaining contents (approximately 40% syllabus but excluding contents covered in IA-1). Duration of each test shall be one hour. Average of the two tests will be considered as IA marks.

End Semester Examination (80-Marks):

Weightage to each of the modules in end-semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of **total 06** questions, each carrying **20 marks**.
2. **Question No: 01** will be **compulsory** and based on entire syllabus wherein 4 to 5 sub-questions will be asked.
3. Remaining questions will be mixed in nature and randomly selected from all the modules.
4. Weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.
5. **Total 04 questions** need to be solved.

ECC304 - Network Theory

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECC 305	Network Theory	03	--	01	03	--	01	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Exam. Duration (in Hrs)	Term Work	Practical And Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. Of Test 1 and Test 2					
ECC 305	Network Theory	20	20	20	80	03	25	--	125

Course Pre-requisite:

- ☐ Basic Electrical Engineering
- ☐ Solution to Differential Equations and Laplace Transform

Course Objectives:

1. To analyze the Circuits in time and frequency domain
2. To study network Topology, network Functions, two port network
3. To synthesize passive network by various methods

Course Outcome:

After successful completion of the course student will be able to

1. Apply their knowledge in analyzing Circuits by using network theorems.
2. Apply the time and frequency method of analysis.
3. Evaluate circuit using graph theory.
4. Find the various parameters of two port network.
5. Apply network topology for analyzing the circuit.
6. Synthesize the network using passive elements.

Module No.	Unit No.	Topics	Hrs.
1.0		Electrical circuit analysis and Graph Theory	09
	1.1	Analysis of DC Circuits: Analysis of Circuits with dependent sources using generalized loop and node analysis, super mesh and super node analysis technique Circuit Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer (No numerical with AC source in ESE).	
	1.2	Graph Theory: Linear Oriented Graphs, graph terminologies Matrix representation of a graph: Incidence matrix, Circuit matrix, Cut-set matrix, reduced Incident matrix, Tieset matrix, f-cutset matrix. Relationship between sub matrices A, B & Q KVL & KCL using matrix (No numerical) .	
2.0		Time & Frequency domain analysis and Network Function	8
	2.1	Time domain analysis of R-L and R-C Circuits: Forced and natural response, initial and final values Solution using first order differential using step signals. Time and frequency domain analysis of R-L-C Circuits: Forced and natural response, effect of damping factor (no numerical)	
	2.2	Network functions for the one port and two port networks, Driving point and transfer functions, Poles and Zeros of Network functions, necessary condition for driving point functions, necessary condition for transfer functions	
3.0		Two port Networks	03
	3.1	Parameters: Open Circuits, short Circuit and Transmission parameters, conditions for reciprocity and symmetry	
	3.2	Interconnections of Two-Port networks T & π representation (Numerical on it are NOT expected in ESE).	
		Total	20

Textbooks :

1. Franklin F Kuo, "Network Analysis and Synthesis", Wiley Toppan, 2nd.ed. ,1966.
2. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 26th Indian Reprint, 2000.

Reference Books:

1. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co., Delhi, 6th Edition.
2. A. Sudhakar, Shyam Mohan S. Palli "Circuits and Networks", Tata McGraw-Hill education.
3. Smarajit Ghosh "Network Theory Analysis & Synthesis", PHI learning.
4. K.S. Suresh Kumar, "Electric Circuit Analysis" Pearson, 2013.
5. D. Roy Choudhury, "Networks and Systems" , New Age International, 1998.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks.

End Semester Examination:

1. Question paper will comprise of **06** questions, each carrying 20 marks.
2. The students need to solve total **04** questions.
- 3: Question **No.1** will be **compulsory** and based on entire syllabus.
- 4: Remaining question (Q.2 to Q.6) will be selected from all the modules.

Term Work:

At least **05 assignments** covering entire syllabus must be given during the “**Class Wise Tutorial**”. The assignments should be students’ centric and an attempt should be made to make assignments more meaningful, interesting and innovative.

Term work assessment must be based on the overall performance of the student with every assignment graded from time to time. The grades will be converted to marks as per “**Credit and Grading System**” manual and should be added and averaged. Based on above scheme grading and term work assessment should be done.

ECC305 - Electronic Instrumentation & Control Systems

Subject Code	Subject Name	Teaching Scheme			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/Practical	Tutorial	Total
ECC305	Electronic Instrumentation & Control System	03	--	-----	03	--	---	03

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical & Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Ave. Of Test 1 and Test 2					
ECC305	Electronic Instrumentation & Control System	20	20	20	80	--	--	--	100

Prerequisites: Basics of Electronics and Electrical Engineering.

Course Objectives:

- 1.To provide basic knowledge about the various sensors and transducers
2. To provide fundamental concepts of control system such as mathematical modeling, time response and Frequency response.
3. To develop concepts of stability and its assessment criteria.

Course Outcomes: Students will be able to:

1. Identify various sensors, Transducers and their brief performance specification.
2. Understand principle of working of various transducer used to measure Temperature, Displacement, level and their application in industry
3. Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.

4. Evaluate the transfer functions for a given Control system.
5. Understand the analysis of system in time domain and frequency domain.
6. Predict stability of given system using appropriate criteria.

Module No.	Section No.	Topics	Hrs.
1.		Principle of Measurement, Testing and Measuring instruments	05
	1.1	Introduction to Basic instruments: Components of generalized measurement system, Concept of accuracy, precision, linearity, sensitivity, resolution, hysteresis, calibration.	
	1.2	Measurement of Resistance : Kelvin's double bridge, Wheatstone bridge and Mega ohm bridge Measurement of Inductance: Maxwell bridge and Hey bridge Measurement of Capacitance: Schering bridge	
2.		Stability Analysis in Time Domain	05
	2.1	Root locus Analysis: Root locus concept, general rules for constructing root-locus, Root locus analysis of control system	
3		Stability Analysis in frequency domain	10
	3.1	Introduction: Frequency domain specification, Relationship between time and frequency domain specification of system, stability margins	
	3.2	Bode Plot: Magnitude and phase plot, Method of plotting Bode plot, Stability margins and analysis using bode plot. Frequency response analysis of RC, RL, RLC circuits	
	3.3	Nyquist Criterion: Concept of Polar plot and Nyquist plot, Nyquist stability criterion, gain and phase margin	
		Total	20

Textbooks :

1. A.K. Sawhney, "Electrical & Electronic Measurement & Instrumentation" – DRS . India
2. B.C Nakra, K.K. Cahudhary, Instrumentation Measurement and Analysis, Tata Mc Graw Hill.
3. W.D. Cooper, "Electronic Instrumentation And Measuring Techniques" – PHI
4. Nagrath, M.Gopal, "Control System Engineering", Tata McGraw Hill.

5. Rangan C. S., Sarma G. R. and Mani V. S. V., "Instrumentation Devices And Systems", Tata McGraw-Hill, 2nd Ed., 2004.
6. K.Ogata, "Modern Control Engineering, Pearson Education", IIIrd edition.

Reference Books:

1. Helfrick&Copper, "Modern Electronic Instrumentation & Measuring Techniques" – PHI
2. M.M.S. Anand, "Electronic Instruments and instrumentation Technology".
3. Gopal M., "Control Systems Principles and Design", Tata McGraw Hill Publishing Co. Ltd. New Delhi, 1998.
4. Benjamin C.Kuo, "Automatic Control Systems, Pearson education", VIIth edition
5. Doebelin E.D., Measurement system, Tata Mc Graw Hill., 4th ed, 2003.Madan Gopal, "Control Systems Principles and Design", Tata McGraw hill, 7th edition,1997.
6. Normon, "Control System Engineering", John Wiley & sons, 3rd edition.

Internal Assessment (IA):

Two tests must be conducted which should cover at least 80% of syllabus. The average marks of both the test will be considered as final IA marks

End Semester Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. The students need to solve total 4 questions.
- 3: Question No.1 will be compulsory and based on entire syllabus.
- 4: Remaining question (Q.2 to Q.6) will be selected from all the modules.

Term Work:

Term work assessment must be based on the overall performance of the student with every assignment graded from time to time. The grades will be converted to marks as per "**Credit and Grading System**" manual and should be added and averaged. Based on above scheme grading and term work assessment should be done.

ECL303 – Electronic Instrumentation & Control Systems Lab

Subject Code	Subject Name	Teaching Scheme (Hrs.)	Credits Assigned					
		Theory	Practical	Tutorial	Theory	TW/Pracs	Tutorial	Total
ECL305	Electronic Measurement and Control system Laboratory	--	02	--	--	1	--	1

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical & Oral	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. Of Test 1 and Test 2					
ECL305	Electronic Measurement and Control system Laboratory	--	--	--	--	25	-	--	25

Course Pre-requisites: Basics of Electrical and Electronics Engineering
Signals and Systems

Course Objectives:

- Introduction to Electronics instruments for measurement of different physical and electrical parameter.
- To simulate and analyze different parameters of control system.
- To discuss stability of control system using various criteria.

Course outcomes: After successful completion of the course student will be able to

1. Explain the principle of working of various transducers and their application in industry.
2. Measure the physical and electrical parameters of various transducers and sensors.
3. Understand the concept of first order and second order systems with their frequency response.
4. Solve problems and calculate the time response specification of control system.

Laboratory plan

Maximum of 5 practicals

List of Experiments

1. Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
2. Designing AC bridge Circuit for capacitance measurement.
3. To inspect the relative stability of systems Root-Locus using Simulation Software.
4. To determine the frequency specification from Polar plot of system.
5. To inspect the stability of system by Nyquist plot using Simulation software.
6. To inspect the stability of system by Bode plot using Simulation software.

Term Work:

At least 05 Experiments covering entire syllabus must be given during the “**Laboratory session batch wise**”.

Computation/simulation-based experiments are also encouraged. The experiments should be students centric and attempt should be made to make experiments more meaningful, interesting and innovative.

ECL304 - Skill Lab: C++ and Java Programming

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECL304	Skill Lab: C++ and Java Programming	--	04	--	--	02	--	02

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical And Oral	Total
		Internal assessment			End Sem. Exam			
		Test 1	Test 2	Avg. Of Test 1 and Test 2				
ECL304	Skill Lab: C++ and Java Programming	--	--	--	--	25	25	50

Note: Before performing practical ‘Necessary Theory’ will be taught by concern faculty

Course Pre-requisites:

1. FEL204 - C-Programming

Course Objectives:

1. Describe the principles of Object Oriented Programming (OOP).
2. To understand object-oriented concepts such as data abstraction, encapsulation, inheritance and polymorphism.
3. Utilize the object-oriented paradigm in program design.
4. To lay a foundation for advanced programming.
5. Develop programming insight using OOP constructs.

Course Outcomes:

After successful completion of the course student will be able to:

1. Describe the basic principles of OOP.
2. Design and apply OOP principles for effective programming.
3. Develop programming applications using OOP language.
4. Implement different programming applications using packaging.
5. Analyze the strength of OOP.
6. Percept the Utility and applicability of OOP.

Module No.	Unit No.	Topics	Hrs.
1.0		C++ Control Structures	05
	1.1	Branching - If statement, If-else Statement, Decision. Looping – while, do-while, for loop Nested control structure - Switch statement, Continue statement, Break statement.	
	1.2	Array - Concepts, Declaration, Definition, Accessing array element, One-dimensional and Multidimensional array.	
2.0		Object-Oriented Programming using C++	10
	2.1	Operator Overloading - concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion, Keywords explicit and mutable. Function - Function prototype, accessing function and utility function, Constructors and destructors, Copy Constructor, Objects and Memory requirements, Static Class members, data abstraction and information hiding, inline function. Constructor - Definition, Types of Constructor, Constructor Overloading, Destructor.	
	2.2	Inheritance - Introduction, Types of Inheritance, Inheritance, Public and Private Inheritance, Multiple Inheritance, Ambiguity in Multiple Inheritance, Visibility Modes Public, Private, Protected and Friend, Aggregation, Classes Within Classes. Deriving a class from Base Class, Constructor and destructor in Derived Class, Overriding Member Functions, Class Hierarchies, Polymorphism - concept, relationship among objects in inheritance hierarchy, Runtime & Compile Time Polymorphism, abstract classes, Virtual Base Class.	
3.0		Java : Introduction, Inheritance, Polymorphism & Encapsulation	09
	3.1	Programming paradigms- Introduction to programming paradigms, Introduction to four main Programming paradigms like procedural, object oriented, functional, and logic & rule based. Difference between C++ and Java.	
	3.2	Classes and Methods : class fundamentals, declaring objects, assigning object reference variables, adding methods to a class, returning a value, constructors, this keyword, garbage collection, finalize() method, overloading methods, argument passing, object as parameter, returning objects, access control, static, final, nested and inner classes, command line arguments, variable-length Arguments. String : String Class and Methods in Java.	
	3.3	Inheritances : Member access and inheritance, super class references, Using super, multilevel hierarchy, constructor call sequence, method overriding, dynamic method dispatch, abstract classes, Object class. Packages and Interfaces : defining a package, finding packages and CLASSPATH, access protection, importing packages, interfaces (defining, implementation, nesting, applying), variables in interfaces, extending interfaces, instance of operator.	
		Total	24

Suggested list of Experiments:

Note: Before performing practical necessary Theory will be taught by concern faculty

Sr.No	Write C++ Program to
1	Add Two Numbers
2	Print Number Entered by User
3	Swap Two Numbers
4	Check Whether Number is Even or Odd
5	Find Largest Number Among Three Numbers
6	Create a simple class and object.
7	Create an object of a class and access class attributes
8	Create class methods
9	Create a class to read and add two distance
10	Create a class for student to get and print details of a student.
11	Demonstrate example of friend function with class
12	Implement inheritance.

Sr. No.	Write JAVA Program to
1	Display addition of number
2	Accept marks from user, if Marks greater than 40, declare the student as "Pass" else "Fail"
3	Accept 3 numbers from user. Compare them and declare the largest number (Using if-else statement).
4	Display sum of first 10 even numbers using do-while loop.
5	Display Multiplication table of 15 using while loop.
6	Display basic calculator using Switch Statement.
7	Display the sum of elements of arrays.
8	Accept and display the string entered and execute at least 5 different string functions on it.
9	Read and display the numbers as command line Arguments and display the addition of them
10	Define a class, describe its constructor, overload the Constructors and instantiate its object.
11	Illustrate method of overloading
12	Demonstrate Parameterized Constructor
13	Implement Multiple Inheritance using interface
14	Create thread by implementing 'Runnable' interface or creating 'Thread Class.
15	Demonstrate Hello World Applet Example

Textbooks:

1. Bjarne Stroustrup, “The C++ Programming language”, Third edition, Pearson Education.
2. Yashwant Kanitkar, “Let Us Java”, 2nd Edition, BPB Publications.
3. D.T. Editorial Services, “Java 8 Programming Black Book”, Dreamtech Press, Edition: 2015
4. Deitel, “C++ How to Program”, 4th Edition, Pearson Education.

Reference Books:

1. Herbert Schidt, “The Complete Reference”, Tata McGraw-Hill Publishing Company Limited, Ninth Edition.
2. Java: How to Program, 8/e, Dietal, PHI.
3. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Languageser Guide”, Pearson Education.
4. Sachin Malhotra, Saurabh Chaudhary “Programming in Java”, Oxford University Press, 2010.

Skill-Enhancement:

1. The students should be trained to code in Eclipse (an industry accepted software tool). Also, for a given problem statement, there is need to include external library files (other than JDK files). Moreover, the students need to be trained on Maven (a build tool).
2. Real-life mini-problem statements from software companies (coming in for placement) to be delegated to groups of 3-4 students each and each group to work on the solution for 8-12 hours (last 2 lab sessions).

Software Tools:

1. Raptor-Flowchart Simulation:<http://raptor.martincarlisle.com/>
2. Eclipse: <https://eclipse.org/>
3. Netbeans:<https://netbeans.org/downloads/>
4. CodeBlock:<http://www.codeblocks.org/>
5. J-Edit/J-Editor/Blue J

Online Repository:

1. Google Drive
2. GitHub

Term Work:

At least **08** experiments (**04 experiments** each on **C++** and **JAVA**) covering entire syllabus should be set to have well predefined inference and conclusion. Teacher should refer the suggested experiments and can design additional experiment to maintain better understanding and quality.

The experiments should be students centric and attempt should be made to make experiments more meaningful, interesting and innovative.

Term work assessment must be based on the overall performance of the student with every Experiments are graded from time to time.

The grades will be converted to marks as per “**Choice Based Credit and Grading System**” manual and should be added and averaged. Based on above scheme grading and term work assessment should be done.

The practical and oral examination will be based on entire syllabus. Students are encouraged to share their experiments codes on online repository. Practical exam should cover all **08** experiments for examination.

ECM301 - Mini Project 1A

Course Code	Course Name	Teaching Scheme (Hrs.)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ECM301	Mini Project 1A	--	04 ^{\$}	--	--	2	--	2

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical And Oral	Total
		Internal assessment			End Sem. Exam			
		Test1	Test2	Avg. Of Test1 and Test2				
ECM301	Mini Project 1A	--	--	--	--	25	25	50

\$ Indicates work load of a learner (Not Faculty) for Mini Project 1A. Faculty Load: 1 hour per week per four groups.

Objectives

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of self-learning and research.

Outcome: At the end of the course learners will be able to...

1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as member of a group or leader.
4. Draw the proper inferences from available results through theoretical/ experimental/simulations.
5. Analyse the impact of solutions in societal and environmental context for sustainable development.
6. Use standard norms of engineering practices
7. Excel in written and oral communication.
8. Demonstrate capabilities of self-learning in a group, which leads to life long learning.
9. Demonstrate project management principles during project work.

Guidelines for Mini Project

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini project.
- A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and report to be compiled in standard format of University of Mumbai.
- With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Mini Projects, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Mini Project 1 in semester III and IV. Similarly, Mini Project 2 in semesters V and VI.
- However, based on the individual students or group capability, with the mentor's recommendations, if the proposed Mini Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Mini Project with suitable improvements/modifications or a completely new project idea in even semester. This policy can be adopted on case by case basis.

Guidelines for Assessment of Mini Project: Term

Work

- The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of Term work marks for both semesters shall be as below;
 - Marks awarded by guide/supervisor based on log book : 10
 - Marks awarded by review committee 10
 - Quality of Project report 05

Review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.