

COURSE FILE (2022-23)

Department: **ELECTRONICS & COMMUNICATION ENGINEERING**

Class: **Sem**

Course Title: **Radar Engineering**


Course code: **18EC823**

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1. Course details

1.1 Primary information

1	Course Code	18EC823
2	L-T-P	3-0-0
3	Course Credit	3
4	Marks (Min/Max)	40/100
	VTU Exam	35/100
	Internal Assessment	16/40
5	Pre-requisite	Analog and Digital Communication, Microwave and Antenna


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6	Teaching Department	Electronics & Communication Engineering
7	Course Duration	40 Hours
8	Faculty Handling the course	Mr. Arun Upadhyaya
9	Course Coordinator	Mr. Arun Upadhyaya

1.2 Textbooks

1. Introduction to Radar Systems- Merrill I Skolink, 3e, TMH, 2001.

1.3 Reference Books

1. Radar Principles, Technology, Applications — Byron Edde, Pearson Education, 2004.
2. Radar Principles – Peebles. Jr, P.Z. Wiley. New York, 1998.
3. Principles of Modern Radar: Basic Principles – Mark A. Rkhards, James A. Scheer, William A. Holm. Yesdee, 2013.

1.4 Other Resources (Online, Text, Multimedia, etc.)

1. <https://nptel.ac.in/courses/108/105/108105154/>
2. <https://ocw.mit.edu/resources/res-ll-001-introduction-to-radar-systems-spring-2007/>

1.5 Link of class web page (Google classroom/CANVAS etc.)

<https://classroom.google.com/c/NTk2MTk0MTI0ODE2vtrw6gk>

2. Course Plan

2.1 Course Outcomes

Sl. No.	At the end of the course, Students will be able to	Bloom's Level	Target Attainment
CO1	Understand the basics of radar system and apply the radar range equation to find the maximum range.	L3	2.2
CO2	Examine the range parameters of Radar system which affect the system performance and also understand Radar Cross Section of Targets	L3	2.2
CO3	Explain the working and applications of different types of Radar.	L2	2.2
CO4	Describe the working of various radar antennas and receivers.	L2	2.2

Cognitive levels as per Bloom's Taxonomy: L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating and L6-Creating

2.2 Mapping of COs with POs (Course articulation matrix)

	Engineering Knowledge	Problem Analysis	Design & Development of Solutions	Investigations of Complex	Usage of Modern Tools	Engineer & Society	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Management & Finance	Life-long Learning	PSO1	PSO2
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1							1	3			2	1
CO2	2	1											1	1
CO3	2	1											1	1
CO4	2								1	3			1	

POs Mapping Level: 1-Slightly 2-Moderately 3-Highly

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2.3 Justification for CO-PO mapping

		Justification	Performance Indicator
CO1	PO1	Apply the knowledge of mathematics and engineering fundamentals to derive the equation for radar range.	1.1.1, 1.1.2, 1.3.1, 1.4.1
	PO2	Identify the mathematical, engineering and other relevant knowledge and apply to solve the problems using radar range equation.	2.1.1, 2.1.2, 2.1.3, 2.4.1
	PO9	Demonstrate effective communication skill to explain the concepts like origins of radar and its applications.	9.2.1
	PO10	Read, understand and interpret technical and non-technical information and Deliver effective oral presentations to technical and non-technical audiences by using Use a variety of media effectively to convey a message in a document or presentation to understand concepts like origins of radar and its applications.	10.1.1 10.1.3, 10.2.2, 10.3.1, 10.3.2
	PSO1	Understand the concepts of communication in the field of radar engineering.	--
	PSO2	Apply domain-specific knowledge to understand the use of radar in communication engineering.	--
CO2	PO1	Apply the knowledge of mathematics and engineering fundamentals to determine the impact of noise on radar range equation.	1.1.1, 1.3.1, 1.4.1
	PO2	Identify the mathematical, engineering and other relevant knowledge and apply to solve the problems on modified radar range equation.	2.1.2, 2.1.3 2.2.4, 2.4.1
	PSO1	Apply the concepts of noise in radar communication.	--
	PSO2	Understand the problems related to impact of noise on radar communication.	--
CO3	PO1	Apply the knowledge of mathematics and engineering fundamentals to understand the working and applications of different types of Radar	1.1.1, 1.3.1 1.4.1
	PO2	Identify the mathematical, engineering and other relevant knowledge and apply to solve the problems on Doppler frequency and measurement of speed of targets.	2.1.2, 2.1.3 2.4.1
	PSO1	Understand the range parameters of Radar system which affect the system performance and also understand Radar Cross Section of Targets in radar communication.	--
	PSO2	Understand the problems on Doppler frequency used in radar communication.	--
CO4	PO1	Apply the knowledge of mathematics and engineering fundamentals to understand the working of various radar antennas and receivers.	1.3.1 1.4.1
	PO9	Demonstrate effective communication skill to explain the concepts like types of antennas and receivers.	9.2.1
	PO10	Read, understand and interpret technical and non-technical information and Deliver effective oral presentations to technical and non-technical audiences by using Use a variety of media effectively to convey a message in a document or presentation to understand concepts like types of antennas and receivers.	10.1.1 10.1.3, 10.2.2, 10.3.1, 10.3.2
	PSO1	Understand the use of types of antennas in radar communication systems	--

2.4 Continuous Improvement (Actions taken based on the comments/suggestions of the AY: 2020-21)

SI	Scope for Improvement/Comments/Curriculum Gap (2020-21)	Action Items
1	Most of the topics are covered through Online mode/ Few topics can be covered online mode and remaining through offline	Few topics are covered online mode
2	Need to take more hours to complete the portion	Extra classes taken

2.5 Topic Level Outcomes

Module	Topic	Topic Level Outcomes (TLO)	Blooms Level (L1-L6)	Relevant CO	Assessment Tools
		At the end of the topic, the students will be able to			
Module-1	Basics of Radar: Introduction, Maximum Unambiguous Range, Radar Waveforms, Definitions - PRF, PRI, Duty Cycle, Peak Transmitter Power, Average transmitter Power. Simple form of the Radar Equation, Radar Block Diagram and Operation, Radar Frequencies, Applications of Radar, The Origins of Radar. Illustrative Problems.	1.1 Understand the working principle of Radar system.	L2	CO1	Internal Assessment /Assignment
		1.2 Define parameters related to Radar system.	L1		
		1.3 Explain simple form of Radar equation.	L3		
		1.4 Explain applications of Radar system and origins of Radar.	L2		
Module-2	The Radar Equation: Prediction of Range Performance, Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR, Modified Radar Range Equation, Envelope Detector —Probability of Detection. Radar Cross Section of Targets: sphere, cone-sphere, Transmitter Power, PRF and Range Ambiguities, System Losses. Illustrative Problems.	2.1 Derive the modified equation or radar range with signal to noise ratio.	L2	CO2	Internal Assessment /Assignment
		2.2 Compute probability of detection and false alarm.	L3		
		2.3 Identify different Radar cross section of targets.	L2		
		2.4 Find out transmitter power, pulse repetition frequency and system losses.	L3		
Module-3	MTI and Pulse Doppler Radar: Introduction, Principle, Doppler Frequency Shift, Simple CW Radar, Delay Line Canceller, MTI Radar with – Power Amplifier Transmitter, Blind Speeds, Clutter Attenuation, MTI Improvement Factor, N- Pulse Delay-Line Canceller, Digital MTI Processing – Blind phases, I and Q Channels, Digital MTI Doppler signal processor, Moving Target Detector- Original MTD	3.1 Understand the Principles of MTI and Pulse Doppler Frequency Shift Radars.	L2	CO2	Internal Assessment /Assignment
		3.2 Explain the purpose of delay line canceller and clutter attenuation and derive the frequency response of delay line canceller,	L2		
		3.3 Describe the working of Digital MTI Processing and moving target detectors.	L2		
Module-4	Tracking Radar: Tracking with Radar-Types of Tracking Radar Systems, Monopulse Tracking- Amplitude Comparison Monopulse (one-and two-coordinates), and Phase Comparison	4.1 Understand the types of Tracking Radar Systems.	L2	CO3	Internal Assessment /Assignment
		4.2 Describe mono-pulse tracking.	L2		

	Monopulse. Sequential Lobing , Conical Scan Tracking, Block Diagram of Conical Scan Tracking Radar, Tracking in Range, Comparison of Trackers.	4.3 Explain Conical Scan Tracking Radar.	L2		
Module-5	The Radar Antenna: Functions of The Radar Antenna, Antenna Parameters, Reflector Antennas and Electronically Steered Phased array Antennas. The Radar Receiver, Receiver Noise Figure, Super Heterodyne Receiver, Duplexers and Receivers Protectors, Radar Displays.	5.1 Different functions served by Radar antenna and types of antennas used in radar.	L2	CO4	Internal Assessment /Assignment
		5.2 Understand the Radar receiver and role of duplexer's in Radar system.	L2		
		5.3 Explain different types of Radar display systems, receiver protectors	L2		

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2.6 Course Delivery Schedule

Lect. /Tut No.	Topics to be covered	Relevant TLO	Date on which topics covered	Mode of Delivery	Faculty Sign (Every class)	HoD Sign (Every Module)
Module 1						
L1	Basics of Radar: Introduction, Maximum Unambiguous Range	1.1	17/2	BB	(Signature)	HoD
L2	Radar Waveforms, Definitions with respect to pulse waveform - PRF, PRI,	1.2	17/2	BB	(Signature)	
L3	Definitions with respect to pulse waveform - Duty Cycle, Peak Transmitter Power, Average transmitter Power.	1.2	3/3	BB	(Signature)	
L4	Illustrative Problems	1.2	3/3	BB	(Signature)	
L5	Simple form of the Radar Equation,	1.3	4/3	BB	(Signature)	
L6	Radar Block Diagram and Operation, Radar Frequencies	1.1	10/3	BB	(Signature)	
L7	Illustrative Problems	1.3	10/3	BB	(Signature)	
L8	Applications of Radar, The Origins of Radar	1.4	10/3	Seminars	(Signature)	
Module 2						
L9	The Radar Equation: Prediction of Range Performance,	2.1	11/3	BB PPT	(Signature)	HoD
L10	Detection of signal in Noise, Minimum Detectable Signal, Receiver Noise, SNR,	2.1	17/3	BB PPT	(Signature)	
L11	Modified Radar Range Equation	2.2	17/3	BB	(Signature)	
L12	Envelope Detector — False Alarm Time and Probability	2.2	24/3	BB PPT	(Signature)	
L13	Probability of Detection	2.2	24/3	BB	(Signature)	
L14	simple targets - sphere, cone-sphere, Transmitter Power	2.3	24/3	BB PPT	(Signature)	
L15	PRF and Range Ambiguities, System Losses	2.4	25/3	BB	(Signature)	
L16	Illustrative Problems	2.2	25/3	BB	(Signature)	
Module 3						
L17	MTI and Pulse Doppler Radar: Introduction, Principle	3.1	6/4	BB	(Signature)	HoD
L18	Doppler Frequency Shift, Simple CW Radar, Sweep to Sweep subtraction	3.1	6/4	BB	(Signature)	

L19	Delay Line Canceler, MTI Radar with – Power Amplifier Transmitter	3.2	6/4	BB	(AS)	
L20	Delay Line Cancelers — Frequency Response of Single Delay- Line Canceler	3.2	8/4	BB	(AS)	hi
L21	Blind Speeds, Clutter Attenuation, MTI Improvement Factor	3.2	8/4	BB	(AS)	
L22	N- Pulse Delay-Line Canceler,	3.2	10/4	BB	(AS)	
L23	Digital MTI Processing – Blind phases, I and Q Channels	3.3	10/4	BB	(AS)	hi
L24	Digital MTI Doppler signal processor, Moving Target Detector- Original MTD	3.3	10/4	BB	(AS)	
Module 4						
L25	Tracking Radar: Tracking with Radar- Types of Tracking Radar Systems	4.1	13/4	BB PPT	(AS)	
L26	Monopulse Tracking-Amplitude Comparison Monopulse	4.2	13/4	BB PPT	(AS)	
L26	Phase Comparison Monopulse.	4.2	17/4	BB	(AS)	hi
L28	Sequential Lobing	4.3	17/4	BB	(AS)	
L29	Conical Scan Tracking	4.3	24/4	BB	(AS)	
L30	Block Diagram of Conical Scan Tracking Radar	4.3	24/4	BB	(AS)	hi
L31	Tracking in Range	4.3	25/4	BB	(AS)	
L32	Comparison of Trackers.	4.3	25/4	BB	(AS)	
Module 5						
L33	The Radar Antenna: Functions of The Radar Antenna	5.1	6/5	Seminar	(AS)	
L34	Antenna Parameters, Reflector Antennas	5.1	6/5	Seminar	(AS)	
L35	Electronically Steered Phased array Antennas	5.1	6/5	Seminar	(AS)	hi
L36	The Radar Receiver, Receiver Noise Figure	5.2	7/5	Seminar	(AS)	
L37	Super Heterodyne Receiver	5.2	7/5	Seminar	(AS)	
L38	Duplexers	5.2	7/5	Seminar	(AS)	
L39	Radar Displays	5.3	7/5	Seminar	(AS)	hi
L40	Receivers Protectors	5.3	7/5	Seminar	(AS)	

Signature of Faculty Handling/ Course Coordinator/Module Coordinator

Date: 17/2

HOD

Date: 26/06/23

2.7 Topics Covered Beyond Syllabus

Date	Topic Covered	Relevant PO	Mode of delivery
10/3	Real time application of Radar	PO1	PPT/Seminar
7/5	Radar Displays with real time images	PO1	PPT/Seminar

2.8 Remedial class Details

S. No.	Date	Topic discussed/numerical problem solved	No. of Students attended
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--	---	--	--

2.9 Innovative teaching methods adapted

S. No.	Date	Innovative method adapted	Topics covered
1	8/04/2023	Flipped Class Room	Frequency Response of Single DLC and Blind Speed
2	8/04/2023	Flipped Class Room	N-Pulse DLC
3	24/04/2023	Flipped Class Room	Conical Scanning & Sequential Lobing
4	13/04/2023	Flipped Class Room	Monopulse Tracking

3. Assessment of COs

3.1 Assessment Schedule

Date	Assessment Tool Used	TLOs Assessed	Average Cognitive Level
31/03/2023	IA-1	1.1,1.2,1.3, 1.4, 2.1, 2.2, 2.3, 2.4	2.42
20/04/2023	IA-2	3.1, 3.2, 3.3	2.53
11/05/2023	IA-3	4.1, 4.2, 4.3, 5.1, 5.2, 5.3	2.00


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3.2 Measuring CO Attainment

3.2.1 Direct attainment

TLOs mapped	Assessment Tool Used	Attained Level of Bloom's Taxonomy	Marks allotted	Total Marks	Weightage	Attainment Level	Contribution to CO Attainment	CO - Direct attainment
1.1	IA1	L2	7	30	0.23	3	0.7	1.40
1.2	IA1	L2	8		0.27	0	0	
1.3	IA1	L3	8		0.27	0	0	
1.4	IA1	L2	7		0.23	3	0.7	
2.1	IA1	L3	8	30	0.27	1	0.27	2.07
2.2	IA1	L3	12		0.40	3	1.2	
2.3	IA1	L2	6		0.20	1	0.2	
2.4	IA1	L2	4		0.13	3	0.4	
3.1	IA2	L3	38	90	0.42	3	1.27	2.60
3.2	IA2	L3	16		0.18	2	0.36	
3.3	IA2	L2	6		0.07	3	0.2	
4.1	IA3	L2	7		0.08	0	0	
4.2	IA3	L2	8		0.09	3	0.27	
4.3	IA3	L2	15		0.17	3	0.5	
5.1	IA3	L2	7	30	0.23	0	0	2.30
5.2	IA3	L2	8		0.27	3	0.8	
5.3	IA3	L2	15		0.50	3	1.5	

3.2.2 Indirect attainment (Course end survey)

S. No.	CO questions	Number of students responded			Indirect Attainment Level (3*A+2*B+C)/N
		Strongly agree (A)	Agree (B)	Neutral (C)	
1	Understand the basics of radar system and apply the radar range equation to find the maximum range.	5	3	0	2.333333333
2	Examine the range parameters of Radar system which affect the system performance and also understand Radar Cross Section of Targets	2	6	0	2
3	Explain the working and applications of different types of Radar.	1	7	0	1.888888889
4	Describe the working of various radar antennas and receivers.	1	7	0	1.888888889

3.2.3 Final CO attainment

Sl. No.	Course Outcomes	Direct attainment	Indirect attainment	Final CO = 80% DA + 20% IA
1	Understand the basics of radar system and apply the radar range equation to find the maximum range.	1.4	2.333333333	1.59
2	Examine the range parameters of Radar system which affect the system performance and also understand Radar Cross Section of Targets	2.07	2.07	2.06

3	Explain the working and applications of different types of Radar.	2.6	1.888888889	2.46
4	Describe the working of various radar antennas and receivers.	2.3	1.888888889	2.22

3.3 Observations of Course coordinator on CO attainment

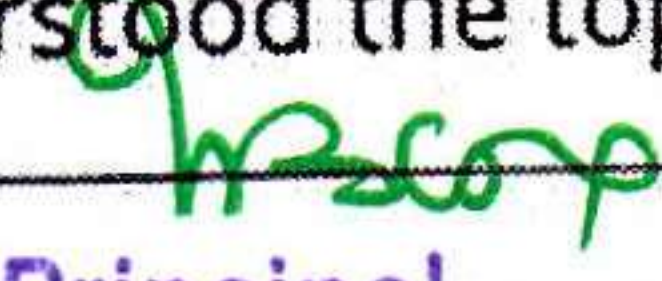
Sl. No.	Course Outcomes	Target	Attainment	Gap	Action Proposed to bridge the Gap	Revision of target wherever achieved
1	Understand the basics of radar system and apply the radar range equation to find the maximum range.	2.2	1.59	0.61	Students should be engaged through online class	2.2
2	Examine the range parameters of Radar system which affect the system performance and also understand Radar Cross Section of Targets	2.2	2.06	0.14	Students should be engaged through online class	2.2
3	Explain the working and applications of different types of Radar.	2.2	2.46	-	-	2.3
4	Describe the working of various radar antennas and receivers.	2.2	2.22	-	-	2.3

3.4 Other Information

	Section - A
Total number of classes held	40
Number of tutorial classes held	-
Number of seminars held	12
Portion coverage	100
Student's feedback	-
No. of students having attendance shortage	-
University result	100
Use of various teaching methods	Black Board, PPT, Video, Google Classroom
Details of the e-content developed	PPT- 32, YouTube Videos - 09 Google Classroom

3.5 Outcomes on Actions of the Observations/Suggestions of the AY: 2021-22


S. No.	Action Taken	Change Observed
1	Seminar were conducted	More Student involvement
2	Innovative teaching methods used	Students understood the topic well




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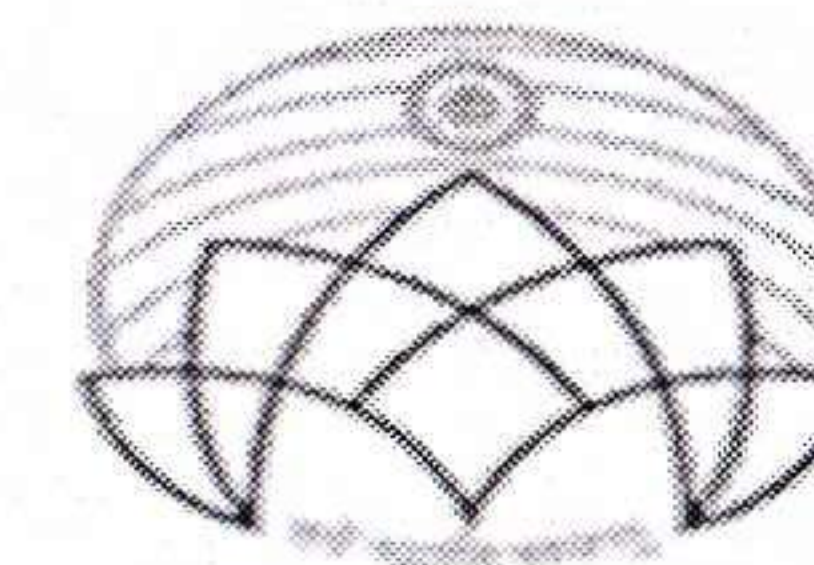
3.6 Comments/Suggestions by the Course Coordinator for the next academic year

S. No.	Comment/Observations	Suggested Actions
1	Many Students missed classes due internships opportunities	Students can be engaged through online class.
2	—	—

Remarks by the Module Coordinator *CO1 & CO2 target to be retained and revision of CO's are suggested for CO3 & CO4*

Signature of  Faculty Handling/Course Coordinator/Module Coordinator
Date: 26/6/23


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Date: 26/6/23

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Measuring Course Outcomes attained through Continuous Internal Evaluation

2019-23 Batch

For 2019-23 Electronics and Communication Engineering students batch, Course Outcomes attained through Continuous Internal Evaluation is as highlighted in Table 2.6.2.a.

Table 2.6.2.a Course Outcomes attained through Continuous Internal Evaluation for 2019-23 Batch

Subject Code	Subject Code	Course Code	CO-Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	IA-Attainment	SEE-Attainment	Average-Attainment	
C101	18MAT11	C101	C101.1	2	3													2.40	2.58	2.49	
		C101	C101.2	1	2														2.30	2.58	2.44
		C101	C101.3	1	3														1.80	2.58	2.19
		C101	C101.4	1	3														2.35	2.58	2.47
		C101	C101.5	2	3														3.00	2.58	2.79
C102	18CHE12	C102	C102.1	3	2										2				2.40	2.43	2.42
		C102	C102.2			3				2					2				3.00	2.43	2.72
		C102	C102.3						1						2				2.80	2.43	2.62
		C102	C102.4							3					2				2.80	2.43	2.62
		C102	C102.5					2							2				2.30	2.43	2.37
C103	18CPS13	C103	C103.1	3	3	2		1										3.00	2.16	2.58	

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		C103	C103.2		3	2	2								1		2.65	2.16	2.41
		C103	C103.3	1	2	2											3.00	2.16	2.58
		C103	C103.4		2	2									1		2.70	2.16	2.43
C104	18ELN14	C104	C104.1	2						1				2	2		2.80	1.97	2.39
		C104	C104.2	2		2								2	2		2.70	1.97	2.34
		C104	C104.3	2		2								2	2		3.00	1.97	2.49
		C104	C104.4	2		2								2	2		3.00	1.97	2.49
C105	18ME15	C105	C105.1	2										1			2.30	1.78	2.04
		C105	C105.2	2										1			3.00	1.78	2.39
		C105	C105.3	2										1			3.00	1.78	2.39
		C105	C105.4	2										1			3.00	1.78	2.39
		C105	C105.5	2										1			3.00	1.78	2.39
C106	18CHEL16	C106	C106.1	3		2							1	2			3.00	2.96	2.98
		C106	C106.2	2		1							1	2			3.00	2.96	2.98
		C106	C106.3					2					1	2			3.00	2.96	2.98
		C106	C106.4				1	3					1	2			3.00	2.96	2.98
C107	18CPL17	C107	C107.1	3													3.00	2.78	2.89
		C107	C107.2	3	3												3.00	2.78	2.89
		C107	C107.3		3	3											3.00	2.78	2.89
		C107	C107.4		3	3											3.00	2.78	2.89
C108	18EGH18	C108	C108.1					1				1	2		3		2.49	2.85	2.67
		C108	C108.2					2				2	2		3		2.49	2.85	2.67

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		C108	C108.3					1				2	2		3			2.49	2.85	2.67	
		C108	C108.4					1				1	1		1			2.49	2.85	2.67	
		C108	C108.5					2				2	3		3			2.49	2.85	2.67	
C109	18MAT21	C109	C109.1	2	3													3.00	2.29	2.65	
		C109	C109.2	1	2														2.35	2.29	2.32
		C109	C109.3	1	3														2.10	2.29	2.2
		C109	C109.4	1	3														3.00	2.29	2.65
		C109	C109.5	2	3														3.00	2.29	2.65
C110	18PHY22	C110	C110.1	3					1						1			3.00	2.29	2.65	
		C110	C110.2									1		1	1			3.00	2.29	2.65	
		C110	C110.3	2	2										1			3.00	2.29	2.65	
		C110	C110.4		2			2							1			3.00	2.29	2.65	
		C110	C110.5						2						1			3.00	2.29	2.65	
C111	18ELE23	C111	C111.1	2											2	2	1	3.00	2.29	2.65	
		C111	C111.2	2	2										2	2	1	3.00	2.29	2.65	
		C111	C111.3		2	2	1		3	3					2	2	1	2.85	2.29	2.57	
		C111	C111.4			2									2	2	1	2.85	2.29	2.57	
		C111	C111.5	2	2										2	2	1	2.70	2.29	2.5	
C112	18CIV24	C112	C112.1	1	2									2		1	3.00	2.29	2.65		
		C112	C112.2	2	2	3									1		3.00	2.29	2.65		
		C112	C112.3	2	2	3									1		2.50	2.29	2.4		
		C112	C112.4	2	2	3									1		3.00	2.29	2.65		

		C112	C112.5	2	2	3									1		1	3.00	2.29	2.65
C113	18EDGL25	C113	C113.1	2				3										3.00	2.52	2.76
		C113	C113.2	3	2	2		3										3.00	2.52	2.76
		C113	C113.3	3	2	2		3										3.00	2.52	2.76
		C113	C113.4	3	2	2		3										3.00	2.52	2.76
		C113	C113.5	3	3	3	2	3										3.00	2.52	2.76
C114	18PHYL26	C114	C114.1	3				1	2			1	1		1			3.00	2.29	2.65
		C114	C114.2	3	2	1						1	1		1			3.00	2.29	2.65
		C114	C114.3	3	2							1	1		1			3.00	2.29	2.65
		C114	C114.4	3								1	1		1			3.00	2.29	2.65
C115	18ELE27	C115	C115.1			2	2				2	2	2		3	3	3	3.00	2.29	2.65
		C115	C115.2		2		2	2			2	2	2		3	3	3	3.00	2.29	2.65
		C115	C115.3			2	2	2			2	2	2		3	3	3	3.00	2.29	2.65
		C115	C115.4		2	2		2			2	2	2		3	3	3	3.00	2.29	2.65
		C115	C115.5			2		2			2	2	2		3	3	3	3.00	2.29	2.65
C116	18EGH28	C116	C116.1					1				2	2		3			2.95	2.82	2.89
		C116	C116.2					2				2	2		2			2.95	2.82	2.89
		C116	C116.3					2				2	3		2			2.95	2.82	2.89
		C116	C116.4					2				2	3		2			2.95	2.82	2.89
		C116	C116.5					2				2	3		3			2.95	2.82	2.89
C201	18MAT31	C201	C201.1	3	3										1			2.76	1.46	2.11
		C201	C201.2	3	2											1			2.75	1.46

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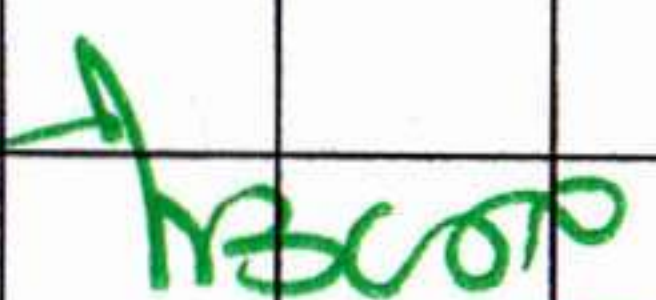
		C201	C201.3	3	3									1			2.76	1.46	2.11
		C201	C201.4	3	2									1			2.39	1.46	1.93
		C201	C201.5	3	2									1			2.56	1.46	2.01
C202	18EC32	C202	C202.1	3	2			2				1			2		2.77	0.73	1.75
		C202	C202.2	3	2			2				1			2		2.77	0.73	1.75
		C202	C202.3	3	2			2				1			2		2.42	0.73	1.58
		C202	C202.4	3	2			2				1			2		2.13	0.73	1.43
		C202	C202.5	3	2			2				1			2		2.43	0.73	1.58
C203	18EC33	C203	C203.1	2				2				2			2		2.4	1.11	1.76
		C203	C203.2	3	1			2				2			2	2	2.7	1.11	1.91
		C203	C203.3	3	2			2				2			2	2	2.5	1.11	1.81
		C203	C203.4	3	2			2				2			2	2	2	1.11	1.56
		C203	C203.5	2											2	2		2.6	1.11
C204	18EC34	C204	C204.1	3	2			1						2	3	1	2.84	1.62	2.23
		C204	C204.2	3	2	2		1						2	3	2	2.81	1.62	2.22
		C204	C204.3	3	2	1		1						2	3	1	2.2	1.62	1.91
		C204	C204.4	3	3	2						2	2		2	3	2	1.86	1.62
C205	18EC35	C205	C205.1	2								2			1		2.8	1.34	2.07
		C205	C205.2	2	2			1				2			1		2.77	1.34	2.06
		C205	C205.3	2				1							1		2.17	1.34	1.76
		C205	C205.4	2											1		2.38	1.34	1.86
		C205	C205.5	2	2							2			1		2.76	1.34	2.05

C206	18EC36	C206	C206.1	2	2							1		2		2.8	1.39	2.1	
		C206	C206.2	2	2								1		2		2.51	1.39	1.95
		C206	C206.3	2	1								1		2		2.78	1.39	2.09
		C206	C206.4	2	1								1		2		2.79	1.39	2.09
		C206	C206.5	2	1								1	1	2		2.78	1.39	2.09
C207	18ECL37	C207	C207.1	3	2		1	1			2	1				2.8	2.78	2.79	
		C207	C207.2	3	2		1	1			2	1		2		2.81	2.78	2.8	
		C207	C207.3	3	2		2	3			1	1	1	2		2.82	2.78	2.8	
C208	18ECL38	C208	C208.1	2	2					2	3	3		3	2	2.81	2.62	2.72	
		C208	C208.2	2	1					2	3	3		3	2	2.79	2.62	2.71	
		C208	C208.3	2	1			2		2	3	3		3	2	2.77	2.62	2.7	
		C208	C208.4	2	1			3		2	3	3		3	2	2.79	2.62	2.71	
		C208	C208.5	2	2			2		3		3		3	2	2.79	2.62	2.71	
C209	18MAT41	C209	C209.1	3	1								1			2.8	1.36	2.08	
		C209	C209.2	3	1								1			2.79	1.36	2.08	
		C209	C209.3	3	3								3			2.81	1.36	2.09	
		C209	C209.4	3	2								1			2.82	1.36	2.09	
		C209	C209.5	3	3								3			2.82	1.36	2.09	
C210	18EC42	C210	C210.1	3	2						1	1	1	2		2.81	1.36	2.09	
		C210	C210.2	3	2							1	1	2		2.8	1.36	2.08	
		C210	C210.3	3	1							1	1	2		2.82	1.36	2.09	
		C210	C210.4	3	2			2				1	1	2	2	3	2.81	1.36	2.09

		C210	C210.5	3	2			2				1	1		2	2	3	2.81	1.36	2.09
C211	18EC43	C211	C211.1	3	2										3			2.78	1.36	2.07
		C211	C211.2	3	1										3			2.81	1.36	2.09
		C211	C211.3	3	1										3			2.43	1.36	1.9
		C211	C211.4	3	2										3			2.46	1.36	1.91
		C211	C211.5	3	2										3			2.79	1.36	2.08
C212	18EC44	C212	C212.1	2	3										2			2.79	1.36	2.08
		C212	C212.2	2	3										2			2.79	1.36	2.08
		C212	C212.3	3	3										3			2.79	1.36	2.08
		C212	C212.4	2	3										1			2.78	1.36	2.07
		C212	C212.5	2	3										1			2.81	1.36	2.09
C213	18EC45	C213	C213.1	3	2										2	3		2.83	1.36	2.1
		C213	C213.2	3	3	2									3	3	3	2.81	1.36	2.09
		C213	C213.3	3	3	2									3	3	3	2.28	1.36	1.82
		C213	C213.4		3	2									3	3	2	2.879	1.36	2.12
		C213	C213.4	2	2	3									3	3	3	1.98	1.36	1.67
C214	18EC46	C214	C214.1	2	1							1			2			2	1.36	1.68
		C214	C214.2	2	1							1			2			2.8	1.36	2.08
		C214	C214.3	2	1							1			2			1.99	1.36	1.68
		C214	C214.4	2	1							1			2			1.92	1.36	1.64
		C214	C214.4	2	1							1			2			2.72	1.36	2.04
C215	18ECL47	C215	C215.1	2	1			3						1			2.8	1.36	2.08	

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		C215	C215.2	2	2	2		3		1		1	1		1	2	2	2.8	1.36	2.08
		C215	C215.3	2	2	2		3		1		1	1		2	2	2	2.8	1.36	2.08
C216	18ECL48	C216	C216.1	2	3	1						1			1		2	2.81	1.36	2.09
		C216	C216.2	2	3	1						1			1		2	2.81	1.36	2.09
		C216	C216.3	2	3			3				1			1		2	2.41	1.36	1.89
		C216	C216.4							2	1	3			1			2.81	1.36	2.09
C217	18CPC49	C217	C217.1					3				2	2		3			3	1.36	2.18
		C217	C217.2					3		3	2	2			3			3	1.36	2.18
		C217	C217.3					3			2	2			1			3	1.36	2.18
C301	18ES51	C301	C301.1	1								2	2		1			2.84	2.49	2.67
		C301	C301.2	1											1			2.83	2.49	2.66
		C301	C301.3	1											1			2.84	2.49	2.67
		C301	C301.4	1											1			2.82	2.49	2.66
C302	18EC52	C302	C302.1	3	2										3			2.26	1.93	2.1
		C302	C302.2	3	2										3			2.09	1.93	2.01
		C302	C302.3	3	3										3	3		2.82	1.93	2.38
		C302	C302.4	3	3										3	3		2.8	1.93	2.37
		C302	C302.5	2											3			2.52	1.93	2.23
C303	18EC53	C303	C303.1	3	2										3			1.95	1.85	1.9
		C303	C303.2	3	2										3			2.39	1.85	2.12
		C303	C303.3	3	3			2							3			2.27	1.85	2.06
		C303	C303.4	2											3			2.8	1.85	2.33


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 Vishwathama Nagar, Udipi Dist.
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C304	18EC54	C304	C304.1	3	3									2	2.57	2.24	2.41	
		C304	C304.2	2	3										2	1.74	2.24	1.99
		C304	C304.3	3	2										2	2.14	2.24	2.19
		C304	C304.4	3	3										2	2.02	2.24	2.13
C305	18EC55	C305	C305.1	2	1											1.72	1.77	1.75
		C305	C305.2	2	1											2.26	1.77	2.02
		C305	C305.3	2	1											2.07	1.77	1.92
		C305	C305.4	2	1											2.19	1.77	1.98
		C305	C305.5	2	1											2.76	1.77	2.27
C306	18EC56	C306	C306.1	3	2									3	2.4	2.41	2.41	
		C306	C306.2	3	2									3	2.31	2.41	2.36	
		C306	C306.3	2	2									3	1.92	2.41	2.17	
		C306	C306.4	3	2									3	2.83	2.41	2.62	
		C306	C306.5	3		2		3						3	2.83	2.41	2.62	
C307	18ECL57	C307	C307.1	2	2		3	3				1		3	2.37	2.48	2.43	
		C307	C307.2	2	2		3	3				1		3	2.36	2.48	2.42	
		C307	C307.3	2	2		3	3				1		3	2.46	2.48	2.47	
		C307	C307.4	2	2		3	3				1		3	2.32	2.48	2.4	
C308	18ECL58	C308	C308.1	2				3				1		3	2.26	2.64	2.45	
		C308	C308.2	2				3				1		3	2.21	2.64	2.43	
		C308	C308.3			3		3				1		3	2.13	2.64	2.39	
		C308	C308.4		2			3				1		3	2.2	2.64	2.42	

C309	18CIV59	C309	C309.1						2				2			2.92	2.91	2.92	
		C309	C309.2		2									2			2.52	2.91	2.72
		C309	C309.3											3			1.88	2.91	2.4
		C309	C309.4		2		1							2			1.51	2.91	2.21
C310	18EC61	C310	C310.1	2	1								2	1		1.41	1.74	1.58	
		C310	C310.2	2	2									2	2		2.25	1.74	2
		C310	C310.3	3	2									3	2		2.74	1.74	2.24
		C310	C310.4	2	1					2	2			2	2		2.52	1.74	2.13
		C310	C310.5	2	1					2	2			2	2		2.24	1.74	1.99
C311	18EC62	C311	C311.1	1		2							1	1		2.7	2.27	2.49	
		C311	C311.2	2		1								2		2	2.8	2.27	2.54
		C311	C311.3	2							1	1		1	2		2.8	2.27	2.54
		C311	C311.4	1										1	2		2.8	2.27	2.54
		C311	C311.5	1	2									1	1		2.8	2.27	2.54
C312	18EC63	C312	C312.1	3	3	1									1	2.56	1.6	2.08	
		C312	C312.2	3	3	1									1	2.59	1.6	2.1	
		C312	C312.3	3	3	1									3	2.38	1.6	1.99	
		C312	C312.4	3	3	1									3	2.33	1.6	1.97	
		C312	C312.5	3	3	1						2			3	2.81	1.6	2.21	
C313	18EC646	C313	C313.1	2	1			1					1			2.43	1.59	2.01	
		C313	C313.2	2	1			1					1			2.36	1.59	1.98	
		C313	C313.3	2	1			1					1			2.5	1.59	2.05	

		C313	C313.4	2	1			1						1			2.81	1.59	2.2	
		C313	C313.5	2	1			1						1			2.8	1.59	2.2	
C314	18CS653	C314	C314.1	2										1			1.03	1.45	1.24	
		C314	C314.2	2		1												2.1	1.45	1.78
		C314	C314.3	1	1										2			2.06	1.45	1.76
		C314	C314.4	1		1									1			2.08	1.45	1.77
		C314	C314.5	1	1	1												2.13	1.45	1.79
C315	18CS654	C315	C315.1	2													1.86	1.96	1.91	
		C315	C315.2	2	1													2.64	1.96	2.3
		C315	C315.3	1	1													2.86	1.96	2.41
		C315	C315.4	1	1	1												2.85	1.96	2.41
		C315	C315.5	1	1													2.85	1.96	2.41
C316	18ECL66	C316	C316.1	2	0	0	0	2	0	0	0	0	0	0	0	2		2.1	2.56	2.33
		C316	C316.2	2	2	0	0	0	0	0	0	0	0	0	0	2		2.05	2.56	2.31
		C316	C316.3	2	2	0	0	2	0	0	0	0	0	0	0	2	2	2.01	2.56	2.29
		C316	C316.4	2	2	0	0	0	0	0	0	0	0	0	0	2		2.97	2.56	2.77
C317	18ECL67	C317	C317.1	2	2			2				2	1			2	2.61	2.74	2.68	
		C317	C317.2	2	2							2	1			2	2.67	2.74	2.71	
		C317	C317.3	2	2							2	1			2	2.66	2.74	2.7	
		C317	C317.4	2	1			2				2	1			2	2.63	2.74	2.69	
C318	18ECMP68	C318	C318.1		3		1										2.37	3	2.69	
		C318	C318.2		2		2											2.3	3	2.65

		C318	C318.3	3		3	2	3									2.31	3	2.66
		C318	C318.4				1	3	2	2						2	2.3	3	2.65
		C318	C318.5									2	3				2.31	3	2.66
C401	18EC71	C401	C401.1	2											2		2.84	2.16	2.5
		C401	C401.2	2											2		2.56	2.16	2.36
		C401	C401.3	2	1										2		2.84	2.16	2.5
		C401	C401.4	2	1										2		2.3	2.16	2.23
		C401	C401.5	2	1										2		2.84	2.16	2.5
C402	18EC72	C402	C402.1	3											2		2.3	1.39	1.85
		C402	C402.2	3											2		2.62	1.39	2.01
		C402	C402.3	1	2	1									2		2.04	1.39	1.72
		C402	C402.4	3											2		2.57	1.39	1.98
		C402	C402.5	3											2		2.05	1.39	1.72
C403	18EC733	C403	C403.1	3													2.5	2.15	2.33
		C403	C403.2	3	2							1			2		1.4	2.15	1.78
		C403	C403.3	3	2							1			2		1.14	2.15	1.65
		C403	C403.4	3	2							1			2		2	2.15	2.08
C404	18EC744	C404	C404.1	2	3										2		2.86	2.98	2.92
		C404	C404.2	2	2										2		2.86	2.98	2.92
		C404	C404.3	2	1										2		2.25	2.98	2.62
		C404	C404.4	2	2										2		2.16	2.98	2.57
		C404	C404.5	2	1										2		2.87	2.98	2.93

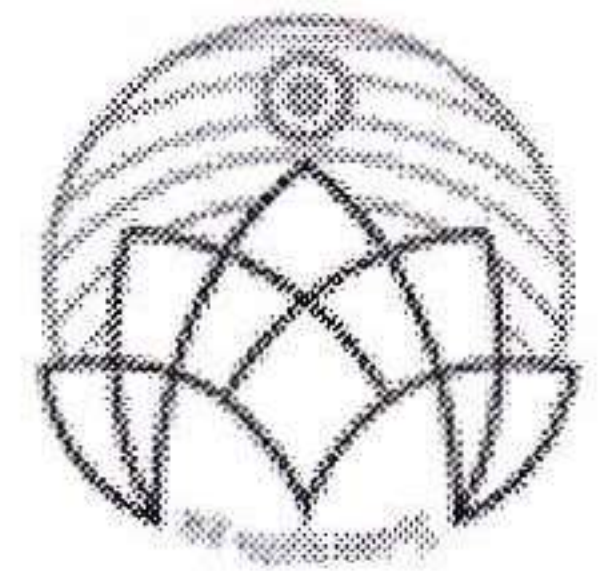
C406	18ECL76	C406	C406.1	3				1				1		1	2	2.09	2.43	2.26
		C406	C406.2	3	2			3			1	2		1	2	2.086	2.43	2.26
		C406	C406.3	3	2			3			1	2		1	2	2.082	2.43	2.26
		C406	C406.4	3	2			3			1	2		1	2	2.082	2.43	2.26
		C406	C406.5	3	2			3			1	2		1	2	2.08	2.43	2.26
C407	18ECL77	C407	C407.1	2				2				2		2		2.86	2.98	2.92
		C407	C407.2	2				2				2		2		2.86	2.98	2.92
		C407	C407.3	2				2				2		2		2.86	2.98	2.92
		C407	C407.4	2				2				2		2		2.86	2.98	2.92
C408	18EC81	C408	C408.1	2				1					1			2.82	1.04	1.93
		C408	C408.2	2									1			2.43	1.04	1.74
		C408	C408.3	2										1		2.6	1.04	1.82
		C408	C408.4	2										1		2.5	1.04	1.77
C409	18EC823	C409	C409.1	2	1					1	3			2	1	1.59	2.9	2.25
		C409	C409.2	2	1									1	1	2.06	2.9	2.48
		C409	C409.3	2	1									1	1	2.46	2.9	2.68
		C409	C409.4	2						1	3			1		2.22	2.9	2.56
C410	18EC824	C410	C410.1	2	1									2		2.37	2.2	2.29
		C410	C410.2	2	1									2		2.88	2.2	2.54
		C410	C410.3	2	1									2		2.88	2.2	2.54
		C410	C410.4	2	1									2		2.87	2.2	2.54
		C410	C410.5	2	1									2		2.88	2.2	2.54

C411	18ECP78/83	C411	C411.1	3	3		3				2			1			2.91	3	2.96
		C411	C411.2	3	3		3				2			1			2.91	3	2.96
		C411	C411.3	3	3	3		3			2			1		2	2.91	3	2.96
		C411	C411.4	3	3	3		3		3	2	3		1			2.85	3	2.93
C412	18ECS84	C412	C412.1						2			1	1		1		2.83	3	2.92
		C412	C412.2	1	1				2			1	1		1		2.84	3	2.92
		C412	C412.3					1				1	1				2.83	3	2.92
C413	18ECI85	C413	C413.1	3		3	3	3							2	2	2.8	3	2.9
		C413	C413.2		3						2		2	2	2	2	2.8	3	2.9
		C413	C413.3									3					2.8	3	2.9

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Measuring Course Outcomes attained through Semester End Examinations

2019-23 Batch

For 2019-23 Batch SEE, the grades of attainment are obtained in accordance with the range of marks as given in Table 2.6.2.b. The number of students within these ranges is determined for every course and the CO attainment for that course is calculated.

Table 2.6.2b Attainment Level Rubrics

Attainment	Range	Level
Attainment 3	>=36	3
Attainment 2	>=30 and <36	2
Attainment 1	>=24 and <30	1
Attainment 0	<24	0

CO Attainment through SEE is computed for each course using the formula:

$$CO \text{ Attainment through SEE} = \frac{\sum_{i=0}^3 ((attainment\ level)_i) * (number\ of\ students\ with\ attainment\ level_i)}{Total\ number\ of\ students\ appeared\ for\ SEE}$$

where *i* represents the attainment level.

The below Table 2.6.2c represents the Semester-wise CO Attainments for all courses from Semester End Examination (SEE) Attainment of the courses offered from 1st semester to 8th semester of Electronics & Communication Engineering 2019-23 Batch.

Table 2.6.2c Semester End Examination (SEE) CO Attainment of 2019-23 Batch

Subject Code	Course Code	SEE-Attainment
18MAT11	C101	2.58
18CHE12	C102	2.43
18CPS13	C103	2.16
18ELN14	C104	1.97
18ME15	C105	1.78
18CHEL16	C106	2.96
18CPL17	C107	2.78
18EGH18	C108	2.85
18MAT21	C109	2.29
18PHY22	C110	2.29
18ELE23	C111	2.29
18CIV24	C112	2.29
18EGDL25	C113	2.29
18PHYL26	C114	2.29
18ELEL27	C115	2.29
18EGH28	C116	2.29
18MAT31	C201	1.46
18EC32	C202	0.73

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18EC33	C203	1.11
18EC34	C204	1.62
18EC35	C205	1.34
18EC36	C206	1.39
18ECL37	C207	2.78
18ECL38	C208	2.62
18MAT41	C209	1.36
18EC42	C210	1.36
18EC43	C211	1.36
18EC44	C212	1.36
18EC45	C213	1.36
18EC46	C214	1.36
18ECL47	C215	1.36
18ECL48	C216	1.36
18CPC49	C217	1.36
18ES51	C301	2.49
18EC52	C302	1.93
18EC53	C303	1.85
18EC54	C304	2.24
18EC55	C305	1.77
18EC56	C306	2.41
18ECL57	C307	2.48
18ECL58	C308	2.64
18CIV59	C309	2.91
18EC61	C311	1.74
18EC62	C312	2.27
18EC63	C313	1.6
18EC646	C314	1.59
18EC653	C315	1.45
18EC654	C316	1.96
18ECL66	C317	2.56
18ECL67	C318	2.74
18ECM68	C319	3
18EC71	C401	2.16
18EC72	C402	1.39
18EC733	C403	2.15
18EC744	C404	2.98
18ME751	C405	2
18CV753	C406	2.43
18ECL76	C407	2.43
18ECL77	C408	2.98
18ECP78	C409	3
18EC81	C410	1.04
18EC823	C411	2.9
18EC824	C412	2.2
18ECP83	C413	3
18ECS84	C414	3
18ECI85	C415	3

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