



ST. XAVIER'S TECHNICAL INSTITUTE

To Nurture the Joy of Excellence in the World of High Technology

CURRICULUM FOR CONTROL SYSTEM

Document Number: PBoS-2526-April-23501-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	CONTROL SYSTEM	RRS	VRR	SBG

EXECUTIVE SUMMARY

This course on **Control System (23501)** is designed to provide students with a fundamental understanding of system modeling, analysis, and stability concepts used in automatic control engineering. The curriculum focuses on developing analytical skills required to design and evaluate dynamic systems.

The course begins with **Fundamentals of Control Systems**, introducing basic concepts, system types, feedback principles, and real-world applications. It further covers **System Components**, explaining the roles of sensors, controllers, actuators, and feedback elements in a control loop. Students are then introduced to **Modeling of Control Systems and Transfer Functions**, where mathematical representations of physical systems are developed to analyze system behaviour. This is followed by **Block Diagram Representation** and **Signal Flow Graph Approach**, enabling simplification and visualization of complex control systems.

The curriculum also emphasizes **Time Domain Analysis and Stability Concepts**, focusing on system response characteristics and conditions for stable operation. Advanced topics include **Root Locus Techniques**, which help in analyzing system performance variation with changing parameters.

Overall, the course provides a strong theoretical and analytical foundation in control system engineering, equipping students with essential skills to model, analyze, and evaluate dynamic systems for engineering applications.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Mr. RakeshKumar Saroj	Subject Expert	
2	Mr. Vinay Naglikar	Subject Expert	

Program Title			Diploma in Electronics & Telecommunication Engineering														
Course Code			Course Title			CONTROL SYSTEMS								Course Type		Semester	
23501														DSE		5	
Learning Scheme						Assessment Scheme											
Actual Contact Hrs./Week			SLH	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total	
CL	TL	LL				FA	SA	Total		FA		SA					
								Max	Min	Max	Min	Max	Min	Max	Min		
3	---	2	1	6	3	---	---	---	---	25	10	50	20	25	10	100	
1) Theory paper duration 3 hrs. 2) Theory paper assessment is Internal and External. 3) The assessment of Practical is Internal and External. 4) Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5) The assessment of Self Learning (SLA) is Internal.																	

RATIONALE:

This subject is classified under the Applied Technology group and is introduced with a view that the students will be exposed to various types of control systems. More emphasis is given for understanding the basic concepts of control systems. Students are required to know the various components of a control system, basic concepts of stability, time domain and frequency domain characteristics, when they are working in process industries.

COURSE OUTCOMES: --

Semester	5	Subject	CONTROL SYSTEMS
CO 501		1st Course in Third Year	
CO 501.1		Classify types of control system, list examples of control system & applications.	
CO 501.2		Apply techniques for Block Diagram reduction and signal flow graph	
CO 501.3		Analyze the behavior of the control system using standard test signals	
CO 501.4		Examine the stability of the control system	
CO 501.5		Inspect the stability of system using Root Locus	
CO 501.6		Demonstrate the Error Detection and Correction mechanism in control system	

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	CONTROL SYSTEMS								
	1 st course in Third Year								
CO 501	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CO 501.1	2	--	2	1	2	1	1	1	0
CO 501.2	2	2	1	1	--	1	--	1	0
CO 501.3	1	1	3	2	1	1	--	1	1
CO 501.4	1	1	--	--	1	1	--	1	1
CO 501.5	1	2	2	2	1	1	--	1	1
CO 501.6	1	2	3	2	1	3	3	1	--
CO TOTAL	8	8	11	8	6	8	4	6	3
CORRELATION LEVEL	1	1	2	1	1	1	1	1	1

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0, 1, 2	3, 4, 5, 6, 7, 8	9, 10, 11, 12, 13, 14	15, 16, 17, 18
CORRELATION LEVEL	0	1	2	3

	Section – 1						
Chapter No	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	FUNDAMENTALS OF CONTROL SYSTEM						
1.1 1.2 1.3 1.4	Introduction Classification of systems Concept of feedback, Types of feedback Open loop and closed loop systems with examples, comparison, advantages and disadvantages.	4	---	---	---	---	CO 501.1
2	MODELLING A CONTROL SYSTEM TRANSFER FUNCTION, BLOCK DIAGRAM REPRESENTATION, SIGNAL FLOW GRAPH APPROACH						
2.1 2.2 2.3 2.4	Concepts of transfer function and problems. Concept of poles, zeros, characteristic Equation pole-zero plot and problems Rules of Block diagram reduction techniques and problems. Concept of Signal flow graph technique and its related problems. (No numericals/problems on conversion of block diagram to signal flow graph).	10	---	---	---	---	CO 501.2
3	TIME DOMAIN STABILITY ANALYSIS						
3.1 3.2 3.3 3.4	Standard test signals: Step, ramp, parabolic, impulse, mathematical and graphical representation of test signals. Classification of control system according to “TYPE” of systems, steady state errors, static error co-efficient, steady state analysis of different types of systems using step, ramp and parabolic input signals. Time response of first and second order systems with standard input signals. Performance characteristics: peak time, delay time, rise time, settling time, peak overshoot definitions, formulae (no derivations), effect of damping factor, numerical problems associated with time response specifications.	10	---	---	---	---	CO 501.3

	Section – 2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
4	STABILITY CONCEPT						
4.1	Concept of stability. Necessary condition for stability.	8	---	---	---	---	CO 501.4
4.2	Routh Hurwitz criteria, Routh's stability criteria: Formation of Routh's array, condition for stable system, limitations, problems.						
5	ROOT LOCUS TECHNIQUES						
5.1	Root locus concept.	8	---	---	---	---	CO 501.5
5.2	Construction of root locus.						
5.3	Problems based on the construction of root locus (simple problems: can be up to third order).						
5.4	Condition of stability for root locus.						
6	SYSTEM COMPONENTS						
6.1	Potentiometers: Potentiometer as a error detector.	8	---	---	---	---	CO 501.6
6.2	Servo amplifiers: Diagram, working, applications.						
6.3	Compensator: basic concept of lead and lag compensator (No Problems).						
6.4	Synchro Transmitters and Receivers.						

IMPLEMENTATION STRATEGY:

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet **(for teachers as well as students)**
- 3) Extensive use of examples
- 4) Group discussions and micro project

LIST OF LABORATORY EXPERIENCES

EXP. NO.	TITLE	COURSE OUTCOME	CHAPT. NO.
1.	To plot the pole-zero configurations in s-plane for the given transfer function.	CO 501.2	2
2.	To obtain transfer function of a given system using block reduction techniques.	CO 501.2	2
3.	Study of Test Signal Generator.	CO 501.3	3
4.	Study and plot the graph of Type '0' control system.	CO 501.3	3
5.	Study and plot the graph of Type '1' control system.	CO 501.3	3
6.	Study and plot the graph of Type '2' control system.	CO 501.3	3
7.	To determine step and impulse response for a first order unity feedback system.	CO 501.3	3
8.	To plot the unit-step response of the given transfer function and find delay time, rise time, peak time, etc.	CO 501.3	3
9.	To plot root locus for a given transfer function using Matlab.	CO 501.5	5
10.	To plot the linearity curve of potentiometer error detector.	CO 501.6	6
11.	To determine gain of potentiometer error detector.	CO 501.6	6
12.	To study Synchro transmitter and receiver system.	CO 501.6	6

IMPLEMENTATION STRATEGY

1. Teaching plan
2. Minimum 10 practical's
3. MATLAB Tool can be use

The table to measure the attainment levels for TERM WORK (on a rating scale of "out of 25") of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, 9,and so on.....)

LAB EXPERIENCE		1	2	3	4	5	6
	COURSE OUTCOMES	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)
STUDENT SPNO							
2303001							
2303002							
2303003							

*The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.

SUGGESTED LIST OF MICROPROJECTS FOR SELF LEARNING

SR. NO.	TITLE
1.	Case studies on any topic related to the course
2.	Assignments / Tutorials.
3.	Springboard training workshops
4.	3D models / charts related to the course

Micro project could be group based. A suggestive list is given here, similar micro projects could be added by concerned faculty. Each student will maintain dated work diary with details of individual contribution. Assessment is done by project guide based on their performance and presentation of submission.

SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Chapter No.	Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
1	FUNDAMENTALS OF CONTROL SYSTEM	4	---	---	---	---
2	MODELLING A CONTROL SYSTEM TRANSFER FUNCTION, BLOCK DIAGRAM REPRESENTATION, SIGNAL FLOW GRAPH APPROACH	10	---	---	---	---
3	TIME DOMAIN STABILITY ANALYSIS CHARACTERISTICS	10	---	---	---	---
Section II						
4	STABILITY CONCEPT	8	---	---	---	---
5	ROOT LOCUS TECHNIQUES	8	---	---	---	---
6	SYSTEM COMPONENTS	8	---	---	---	---
Total		48	---	---	---	---

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	I. J. Nagrath and M. Gopal	Control System Engineering	5th	2008	New Age International Pvt. Ltd.
2.	K. Tandan, A. Subba Rao, Parag Desai, S.K. Kulkarni,	Control Engineering	2nd	---	Dhanpat Rai Sons.
3.	Curtis D. Johnson	Process Control Instrumentation Technology	7th	---	PHI

LEARNING WEBSITES /WEB REFERENCES:

- <https://www.electrical4u.com/control-engineering>
- <https://controlsystem.co.in/>
- <https://nptel.ac.in>
- <https://swayam.gov.in>
- https://econtent.msbt.edu.in/econtent/econtent_home.php



ST. XAVIER'S TECHNICAL INSTITUTE

To Nurture the Joy of Excellence in the World of High Technology

CURRICULUM FOR SATELLITE & MOBILE COMMUNICATION

Document Number: PBoS-2526-April-23502-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	SATELLITE & MOBILE COMMUNICATION	JN & VRR	VRR	SBG



EXECUTIVE SUMMARY

The subject Satellite and Mobile Communication is a core applied technology course designed for Diploma students in Electronics and Telecommunication Engineering. It addresses the rapidly evolving landscape of global communication systems, focusing on satellite-based and wireless mobile technologies that form the backbone of modern telecommunication networks.

The rationale behind this course lies in the increasing demand for high-speed, reliable, and wide-area communication systems. Satellite communication (SATCOM) and mobile communication technologies have revolutionized the way information is transmitted across the globe, enabling services such as broadcasting, navigation, disaster management, and mobile internet connectivity. As a result, students must develop a strong understanding of both domains to meet industry and research requirements.

The course is structured into two major sections: Satellite Communication Systems and Mobile Communication Systems. Together, they provide a comprehensive overview of communication infrastructure, from space-based systems to terrestrial wireless networks.

This course provides a comprehensive foundation in modern communication systems. By integrating theoretical knowledge with practical applications, it prepares students to meet the challenges of the rapidly evolving telecommunications industry. The course not only builds technical expertise but also encourages innovation and adaptability, enabling students to contribute effectively to the development of next-generation communication technologies.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Dr. Janani Natarajan	Subject Expert	
2	Dr. Vijay Rathod	Subject Expert	

Program Title			Diploma in Electronics & Telecommunication Engineering														
Course Code			Course Title			SATELLITE & MOBILE COMMUNICATION								Course Type		Semester	
23502														DSC		5	
Learning Scheme						Assessment Scheme											
Actual Contact Hrs./Week			SLH	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total	
CL	TL	LL				FA	SA	Total		FA		SA					
					Max			Min	Max	Min	Max	Min	Max	Min	Max		Min
3	---	2	1	6	3	30	70	100	40	25	10	50	20	25	10	200	
	1. Theory paper duration 3 hrs. 2. Theory paper assessment is Internal and External. 3. The assessment of Practical is Internal and External. 4. Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5. The assessment of Self Learning (SLA) is Internal.																

RATIONALE:

As improvement and development in the technology have occurred with tremendous rapidity, in parallel with its increasingly wide scale deployment, Telecommunication and Networking based on Satellite and mobile wireless technologies have become major information transmission systems. The glorious 21st century marks the growth of the mobile radio communication industry by orders of magnitude. As a result of accelerating rate of growth of communication technology in research and industry, students who are preparing themselves, and electronics engineers who are working in these areas are faced with the need to understand the theoretical as well as practical design and analysis of satellite and different cellular systems. This subject is classified under Applied Technology group and it is based on communication theory, which gives theoretical as well as practical knowledge of satellite and mobile wireless communication systems.

COURSE OUTCOMES: --

Course theory content, practical skills, experience help student to understand basic terms, functions & uses of satellite & mobile communication, thus student should be able to

Semester	5	Subject	SATELLITE & MOBILE COMMUNICATION
CO 502	2nd Course in Third Year		
CO 502.1	Distinguish various elements of satellite communication system and compare the various frequency bands allotted for SATCOM		
CO 502.2	Classify satellite orbits and analyze the significance of their design parameters in the operation of satellites.		
CO 502.3	Illustrate the working principle of Earth station transmitter receiver and satellite transponder		
CO 502.4	Distinguish various elements and interpret their significance in the operation of Mobile communication system.		
CO 502.5	Appraise the cellular concept and mobile unit.		
CO 502.6	Appreciate the evolution of technology through various mobile generations from 2G to 6G.		

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	SATELLITE & MOBILE COMMUNICATION								
	(2nd Course in Third Year) PREPARED BY: Dr. JN								
CO 502	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CO 502.1	3	2	1	2	1	1	3	1	--
CO 502.2	3	2	2	3	1	1	3	3	--
CO 502.3	3	2	2	3	1	1	3	3	--
CO 502.4	3	3	2	1	1	3	3	--	1
CO 502.5	3	3	2	2	1	3	3	--	3
CO 502.6	3	3	2	2	1	3	3	--	3
CO TOTAL	18	15	11	13	06	12	18	06	06
CORRELATION LEVEL	3	3	2	2	1	2	3	1	1

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0,1,2	3,4,5,6,7,8	9,10,11,12, 13,14	15,16,17,18
CORRELATION LEVEL	0	1	3	3

	Section—1						
Chapter No	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	INTRODUCTION TO SATCOM SYSTEM						
1.1	Definitions – Repeater, transponder, uplink, downlink, earth station, satellite system, Payload, Bus.	08	05	08	----	13	CO 502.1
1.2	Basic block diagram of SATCOM System.						
1.3	SATCOM frequency bands 6/4 Ghz (C Band) 14/12 Ghz (Ku Band) 30/20 Ghz (Ka Band), Comparison.						
1.4	Advantages, Disadvantages and Applications of SATCOM Systems.						
2	SATELLITE ORBITS						
2.1	Definitions – orbit, apogee, perigee, line of Apisides, ascending node, descending node, line of nodes, angle of inclination, prograde and retrograde orbit.	12	05	08	03	16	CO 502.2
2.2	Types of orbits – Equatorial orbit, Polar orbit, Inclined Orbit, Geostationary orbit; LEO, MEO, HEO.						
2.3	Geostationary orbit: features, advantages and disadvantages.						
2.4	Orbital adjustments:						
2.4.1	Orbital spacing.						
2.4.2	Station keeping.						
2.4.3	Satellite stabilization or Attitude Control.						
3.	EARTH STATION AND SATELLITE TRANSPONDER						
3.1	Block diagram of earth station transmitter (C-Band up converter) and Earth station receiver (C-Band down converter).	04	03	03	---	06	CO 502.3
3.2	Block Diagram of 6/4 GHz (C - band) transponder.						

	Section—2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
4	INTRODUCTION TO MOBILE COMMUNICATION SYSTEM						
4.1 4.2 4.3 4.4	Evolution of mobile radio communication. Related definitions- base station, control channel, forward channel, reverse channel, mobile station, mobile switching center, handoff, subscriber, transceiver, roamer. How cellular telephone call is made. Block Diagram and operation of mobile unit, transmitter, receiver, logic unit, control unit & handset.	05	03	02	---	05	CO 502.4
5	THE CELLULAR CONCEPT						
5.1 5.2 5.3 5.4 5.4.1 5.4.2	Introduction to basic cellular system. Frequency reuse. Hand off, Types - hard hand off, soft handoff, delayed and queued hand off. Interference & system capacity: Co channel interference. Adjacent channel interference.	10	02	08	05	15	CO 502.5
6	EVOLUTION OF MOBILE TECHNOLOGIES						
6.1 6.1.1 6.1.2 6.1.3 6.2 6.2.1 6.2.2 6.3 6.3.1 6.3.2 6.4	2G Technology. GSM Network Architecture, Air interface specifications, GSM Call and handoff procedures. 3G Technology. 3G WCDMA Fundamentals. 3G UMTS Network Architecture. Advanced Techniques For 4G and 5G. Block Diagram of 4G LTE Network Architecture. Introduction to 5G network and Technologies: Small cell concepts, Massive MIMO, Beam forming, and mm wave. Comparison of 1G to 5G Mobile Technologies.	09	02	08	05	15	CO 502.6

IMPLEMENTATION STRATEGY:

1. Use of Power Point presentations and Videos.
2. References from the internet **(for teachers as well as students)**.
3. Extensive use of examples.
4. Group discussions and micro project.
5. Assignments for writing skills, create awareness about selection /purchasing components.

LIST OF LABORATORY EXPERIENCES

EXP. NO.	TITLE	COURSE OUTCOME	CHAPT. NO
1.	Direct Link Between Uplink Transmitter & Downlink Receiver.	C 502.1	1
2.	Link Fail Operation Between Transmitter & Receiver.	C 502.3	3
3.	Voice signal and Function Generator Waveform Transmission through Satellite link.	C 502.3	3
4.	Telemetry, Light Intensity & Temperature.	C 502.2	2
5.	Calculate co-channels and cell clusters in a cellular network.	C 502.5	5
6.	Frequency Reuse in Cellular Systems.	C 502.5	5
7.	Study of Mobility Management (Hand over).	C 502.4	4
8.	Measurement of Power Consumption of mobile devices during different communication activities (e.g., voice calls, data transfer, standby mode).	C 502.5	5
9.	Measurement of Signal Strength.	C 502.5	5
10.	Evaluation of mobile network performance metrics - throughput, latency, and packet loss.	C 502.5	5
11.	Analysis of interference mobile communication systems - adjacent channel interference, co-channel interference, and inter-symbol interference.	C 502.5	5
12.	Evaluation of Quality of Service (QoS).	C 502.5	5

IMPLEMENTATION STRATEGY

1. Teaching plan
2. Minimum 10practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, 9,and so on.....)

LAB EXPERIENCE		1	2	3	4	5	6
	COURSE OUTCOMES	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)
STUDENT SPNO							
2303001							
2303002							
2303003							

* The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.

SUGGESTED LIST OF MICROPROJECTS FOR SELF LEARNING

Micro project could be group based. A suggestive list is given here. Similar micro projects could be added by concerned faculty. Each student will maintain dated work diary with details of individual contribution. Assessment is done by concerned faculty based on their performance and presentation of submission.

1. **Market Analysis for Satellite Communication Hardware:** Conduct a market analysis to evaluate the demand for satellite communication hardware, such as antennas, modems, and ground station equipment. Identify key market players, technological advancements, pricing trends, and emerging opportunities. Present the findings in a comprehensive report with recommendations for stakeholders in the satellite communication industry.
 2. **Report on Satellite Communication Standards and Regulations:** Research and compile a report on the current standards and regulations governing satellite communication systems. Cover topics such as frequency allocation, licensing requirements, spectrum management, and international agreements. Analyze the impact of regulatory frameworks on the development and deployment of satellite communication technologies.
 3. **Prototype Model of a Satellite Communication Relay Station:** Develop a prototype model of a satellite communication relay station capable of providing coverage to remote or disaster-stricken areas. Design the relay station to be portable, easy to deploy, and interoperable with existing satellite networks. Test the prototype in simulated field conditions to assess its performance and practicality.
 4. **Report on Emerging Trends in Satellite Communication:** Research and analyze emerging trends in satellite communication technologies, applications, and market dynamics. Explore topics such as small satellite constellations, high-throughput satellites, software-defined payloads, and satellite-based IoT networks. Summarize your findings in a detailed report highlighting opportunities for innovation and investment in the satellite communication sector.
 5. **Prototype Model of a Low-Cost Mobile Phone:** Design and build a prototype model of a low-cost mobile phone targeting price-sensitive markets or budget-conscious consumers. Incorporate essential features such as voice calling, text messaging, and basic internet connectivity while minimizing manufacturing costs.
 6. **Market Analysis for Mobile Device Accessories:** Conduct a market analysis to assess the demand for mobile device accessories such as cases, chargers, headphones, and screen protectors. Identify key market trends, competitive landscape, distribution channels, and consumer preferences. Present the findings in a detailed report with recommendations for manufacturers, retailers, and distributors in the mobile accessories market.
 7. **Prototype Model of a Mobile Network Infrastructure:** Develop a prototype model of a mobile network infrastructure comprising base stations, antennas, and backhaul links. Design the infrastructure to support various mobile technologies and network architectures, such as standalone and non-standalone 5G, LTE, and Wi-Fi.
 8. **Prototype Model of a Mobile Communication App:** Design and develop a prototype model of a mobile communication app tailored for specific use cases, such as messaging, voice calling, video conferencing, or social networking. Incorporate features such as end-to-end encryption, multi-platform compatibility, and intuitive user interface design.
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SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Chapter No.	Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	SECTION I					
1	INTRODUCTION TO SATCOM SYSTEM	8	08	05	---	13
2	SATELLITE ORBITS	12	03	08	05	16
3	EARTH STATION AND SATELLITE TRANSPONDER	04	03	03	---	06
	SECTION II					
4	INTRODUCTION TO MOBILE COMMUNICATION SYSTEM	05	03	02	---	05
5	THE CELLULAR CONCEPT	10	02	08	05	15
6	EVOLUTION OF MOBILE TECHNOLOGIES	9	02	08	05	15
	Total	48	21	34	15	70
	Legends ::R:---Remember, U:---Understand, A:---Application					
	This specification table provides guideline to teacher to teach & assess student also a general guideline to frame theory paper & practical theory exam paper which student have to undertake. The actual distribution of marks at different taxonomy level in the question paper may vary from above table.					

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	D. C. Agarwal	Satellite Communication	1st	2021	Khanna Publishers
2.	Dennis Roddy	Satellite Communication	4th	2017	Tata McGraw-Hill
3.	Gary M. Miller	Modern Electronic communication	6th	1998	Pearson
4.	T. S. Rappaport	Wireless Communication Principles & Practices	2nd	2010	Pearson Education
5.	William Lee	Mobile Cellular Tele Communication	3rd	2005	Tata Mc Graw Hill
6.	Upena Dalal & Manoj K. Shukla	Wireless and Mobile Communication	1st	2016	Oxford University Press

LEARNING WEBSITES /WEBREFERENCES:

- <https://mrcet.com> › digital notes
- <https://lecturenotes.in> › Mobile Communication
- <https://www.researchgate.net>
- [https://www.tutorialspoint.com/microwave components and devices](https://www.tutorialspoint.com/microwave-components-and-devices)
- [http://nptel.ac.in/downloads/satellite communication systems](http://nptel.ac.in/downloads/satellite-communication-systems)
- [http://nptel.ac.in/downloads/wireless and cellular communications](http://nptel.ac.in/downloads/wireless-and-cellular-communications)
- https://econtent.msbt.edu.in/econtent/econtent_home.php



ST. XAVIER'S TECHNICAL INSTITUTE

To Nurture the Joy of Excellence in the World of High Technology

**CURRICULUM FOR MICROWAVE RADAR & FIBER OPTIC
COMMUNICATION**

Document Number: PBoS-2526-APR-23503-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	MICROWAVE RADAR & FIBER OPTIC COMMUNICATION	RVG	VRR	SBG



EXECUTIVE SUMMARY

The **Microwave Radar & Fiber Optic Communication** course is a key component of the Diploma in Electronics & Telecommunication Engineering program, designed to provide students with a thorough understanding of modern communication technologies. This course focuses on microwave communication, radar systems, and Fiber optic communication. Students will explore the fundamental principles, components, and applications of microwave and optical communication systems, as well as basic radar technology.

The course covers both theoretical concepts and practical skills, ensuring students gain a solid foundation in microwave and fiber optic technologies. The practical components allow students to apply the theoretical knowledge to real-world communication scenarios, while also gaining hands-on experience with various communication equipment and devices.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Dr. Mahesh Munde	Subject Expert	
2	Mr. Rameshwar Gheware	Subject Expert	

Program Title					Diploma in Electronics & Telecommunication Engineering												
Course Code			Course Title			MICROWAVE RADAR & FIBER OPTIC COMMUNICATION								Course Type		Semester	
23503														DSC		5	
Learning Scheme						Assessment Scheme											
Actual Contact Hrs./Week			SLH	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total	
CL	TL	LL				FA		SA		Total		FA		SA			
						FA	SA	Max	Min	Max	Min	Max	Min	Max	Min		
3	---	2	1		3	30	70	100	40	25	10	50	20	25	10	200	
	1. Theory paper duration 3 hrs. 2. Theory paper assessment is Internal and External. 3. The assessment of Practical is Internal and External. 4. Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5. The assessment of Self Learning (SLA) is Internal.																

RATIONALE:

Microwave communication is the backbone of terrestrial communication and also the sole of mobile communication. To provide communication at different geographical locations and for specific task microwave links are the established telecommunication solution. Optical communication is developing at very fast pace. Cost trends for fiber vs copper, better transmission quality, high data rate, large bandwidth and reduction in fiber maintenance expense are the major reasons for fast adaptation of this mode of communication. This course has been designed to develop skills in the diploma engineers to maintain microwave and fiber optics-based telecommunication systems.

COURSE OUTCOMES: --

Course theory content, practical skills, experience help student to understand basic terms, functions & uses of Microwave and Fiber Optic, Basic Radar Communication, thus student should able to

Semester	5	Subject	MICROWAVE RADAR & FIBER OPTIC COMMUNICATION
CO 503	3 rd Course in Third Year		
CO 503.1	Analyze the working principle and operation of different microwave devices		
CO 503.2	Identify the role of passive & active microwave components and devices		
CO 503.3	Illustrate the function of Radar systems		
CO 503.4	Analyze Light ray propagation through optical fibers		
CO 503.5	Interpret the constructional features of single mode & multimode fibers		
CO 503.6	Identify the optical losses in optical fiber such as dispersion, scattering, Absorption.		

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	MICROWAVE RADAR & FIBER OPTIC COMMUNICATION								
	3 rd Course in Third Year								
CO 503	P01	P02	P03	P04	P05	P06	P07	PSO 1	PSO 2
CO 503.1	3	2	1	2	1	1	3	2	0
CO 503.2	3	3	2	3	1	1	3	3	0
CO 503.3	3	3	2	3	1	1	3	3	0
CO 503.4	3	2	2	1	1	1	3	3	0
CO 503.5	3	3	2	2	1	1	3	2	0
CO 503.6	3	3	2	2	1	1	3	2	0
CO TOTAL	18	16	11	13	06	06	18	15	0
CORRELATION LEVEL	3	3	2	2	1	1	3	3	0

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0,1,2	3,4,5,6,7,8	9,10,11,12, 13,14	15,16,17,18
CORRELATION LEVEL	0	1	2	3

	Section—1						
Chapter No	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	FUNDAMENTALS OF MICROWAVE COMMUNICATION						
1.1	Microwave Frequency spectrum, Band Designations and Applications of Microwave in Various Fields.	04	02	04	---	06	CO 503.1
1.2	Waveguides. : Types of Waveguides, Advantages and Disadvantages, Applications of Waveguides.						
1.3	Circular Waveguides.						
1.3.1	Construction of Circular Waveguide.						
1.3.2	Cut off wavelength of Circular Waveguide.						
1.3.3	Advantages, Disadvantages.						
1.3.4	Applications of Circular Waveguides.						
1.4	Comparison of Rectangular and Circular Waveguides.						
2	MICROWAVE COMPONENTS						
2.1	Multiple Junctions: Working Principle and Applications of i) E – Plane ii) H- Plane (iii) Magic TEE.	12	05	08	05	18	CO 503.2
2.2	Ferrite Components: Working Principle and Applications of i) Isolator ii) Circulator.						
2.3	Comparison of Isolator and Circulator.						
2.4	Directional Couplers:						
2.4.1	Two Hole Directional Coupler Construction Working Principle and Applications (no numerical, derivation).						
2.5	Microwave Tubes Classification Construction, Bunching Process, Principle of operation and Applications of i) Two Cavity Klystron Amplifier ii) Reflex Klystron.						
2.6	Comparison of Klystron Tubes and TWT.						
2.7	GUNN Diode, PIN Diode: Principle of Operation, Advantages, Disadvantages, Applications						
2.8	Gunn diode as an Oscillator.						
2.9	PIN Diode as an Amplitude Modulator.						
3	INTRODUCTION OF RADAR						
3.1	Basic block diagram of RADAR system, Doppler effect.	12	05	08	05	18	CO 503.3
3.2	Definitions: Radar range, pulse width, Pulse Repetition Frequency (PRF), duty cycle.						
3.3	RADAR range equation derivation (simple numerical), significance of RADAR range, factors affecting RADAR range.						
3.4	Antenna Scanning types: Working principle of Horizontal, vertical, helical & spiral.						
3.5	Antenna Tracking types: Working principle of sequential, conical & mono pulse						

	Section--2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
4	FUNDAMENTALS OF FIBER OPTIC COMMUNICATION						
4.1	Block Diagram of Fiber Optic Communication.	04	04	02	---	06	CO 503.4
4.2	Advantage & disadvantages of Optical Fiber Communication.						
4.3	Definition of Reflection, Diffraction, Dispersion, Absorption and Scattering.						
4.4	Light Wave Spectrum-Definition of Snell's Law, Numerical Aperture Acceptance angle, acceptance cone, Critical Angle.						
5	OPTICAL FIBERS – TYPES AND COMPONENTS						
5.1	Construction of Fiber Optic Cable, Characteristics of Optical Fiber Cables.	12	03	06	08	17	CO 503.5
5.2	Optical Fiber Classifications: Basic details.						
5.2.1	Modes of Propagation: Single Mode Fibers and Multi-Mode Fibers.						
5.2.2	Index Profile of the Optical Fibers: Step Index Fibers and Graded Index Fibers, Single Mode Step Index Fiber, Multi-Mode Step Index Fiber, Multi-Mode Graded Index Fiber.						
5.3	Comparison of Fibers.						
5.3.1	Step Index and Graded Index.						
5.3.2	Single Mode Fibers and Multi-Mode.						
5.4	Light Sources: Requirements of Light Sources, Working Principle of i) LED and (ii) LASER Comparison of LED and LASER.						
5.5	Optical Detectors:						
5.5.1	Requirements of Optical Detector.						
5.5.2	Construction and Working Principle of (i) PIN Photo Diode and (ii) Avalanche Photo Diode.						
5.5.3	Comparison of PIN Diode and APD.						
6	OPTICAL LOSSES						
6.1	Losses in Optical Fibers.	12	03	03	06	12	CO 503.6
6.1.1	Losses due to Attenuation						
6.1.2	Absorption Losses.						
6.1.3	Scattering Losses.						
6.1.4	Bending Losses – Micro and Macro.						
6.1.5	Dispersion Loses - Inter Modal and Intra Modal.						
6.2	Splicing Techniques – V groove Advantages and Disadvantages.						
6.3	OTDR - (Optical Time Domain Reflectometer) Block diagram, working principle.						

IMPLEMENTATION STRATEGY:

1. Use of Power Point presentations and Videos
2. References from the internet **(for teachers as well as students)**
3. Extensive use of examples
4. Group discussions and micro project
5. Assignments for writing skills, create awareness about selection /purchasing components

LIST OF LABORATORY EXPERIENCES

EXP. NO.	TITLE	COURSE OUTCOME	CHAPT. NO.
1	Illustrate the uses of different components of Microwave	CO 503.2	2
2	Characteristics of Reflex Klystron Tube	CO 503.3	3
3	Frequency measurement of Microwave signal using Frequency meter.	CO 503.1	1
4	Frequency measurement and wavelength of X band Reflex Klystron	CO 503.3	3
5	Coupling factor of a Cross-Directional Coupler	CO 503.3	3
6	Measurements on Attenuators	CO 503.3	3
7	Analog Signal Transmission through Fiber Optic Cable	CO 503.4	4
8	Voice Signal Transmission through Fiber Optic Cable	CO 503.4	4
9	Measurement of Bending Losses	CO 503.6	6
10	Measurement of Numerical Aperture	CO 503.6	6
11	Characteristics of LED (Source)	CO 503.5	5
12	Characteristics of PIN (Detector) Diode	CO 503.5	5

IMPLEMENTATION STRATEGY

1. Teaching plan
2. Minimum 10 practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, 9,and so on.....)

LAB EXPERIENCE		1	2	3	4	5	6
	COURSE OUTCOMES	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)
STUDENT SPN							
2303001							
2303002							
2303003							

* The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.

SUGGESTED LIST OF MICROPROJECTS FOR SELF LEARNING

Micro project could be group based. A suggestive list is given here. Similar micro projects could be added by concerned faculty. Each student will maintain dated work diary with details of individual contribution. Assessment is done by concerned faculty based on their performance and presentation of submission.

1. Market survey of consumer microwave equipment with respect to working principle, manufacturer, and technical specifications and submit the detailed report of it.
2. Prepare power point presentations to explain working of various microwave components and microwave tubes.
3. Using LED as optical source, photo diode as optical detector and plastic fiber cable, make prototype optical communication system
4. Prepare survey report to compare technical specifications of different types optical sources and detectors.
5. Prepare report to compare technical specifications of different types RADAR systems
6. Prepare a prototype of Radar system.

SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Chapter No.	Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	Section I					
1	FUNDAMENTALS OF MICROWAVE COMMUNICATION	04	02	04	--	06
2	MICROWAVE COMPONENTS	12	05	08	05	18
3	INTRODUCTION OF RADAR	08	03	05	03	11
	Section II					
4	FUNDAMENTALS OF FIBER OPTIC COMMUNICATION	04	04	02	-	06
5	FIBER OPTIC COMMUNICATION - TYPES AND COMPONENTS	12	03	06	08	17
6	OPTICAL LOSSES	08	03	03	06	12
	Total	48	18	22	30	70
	Legends:: R::--Remember, U::--Understand, A::--Application					
This specification table provides guideline to teacher to teach & assess student also a general guideline to frame theory paper & practical theory exam paper which student have to undertake. The actual distribution of marks at different taxonomy level in the question paper may vary from above table.						

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	Das Annapurna and Das S.K.	Microwave Engineering	3rd	2017	McGraw Hill, New Delhi.
2.	Sanjeev Gupta	Microwave Engineering	3rd	2004	Khanna Publications New Delhi
3.	Liao Samuel Y	Microwave devices & circuits	Latest		PHI Learning, New Delhi
4.	Kolimbiris, Harold	Fiber optic communication	3rd	2010	Pearson Prentice Hall, New Delhi
5.	A. Selverajan	Optical Fiber Communication	3rd	2010	Tata McGraw-Hill, New Delhi
6.	Gary Miller	Modern Electronic communication	Latest	-	Prentice Hall of India, New Delhi
7.	Keiser	Optical Fiber Communication	Latest	-	Tata McGraw-Hill International

LEARNING WEBSITES /WEB REFERENCES:

- [https://www.tutorialspoint.com/microwave components and devices](https://www.tutorialspoint.com/microwave-components-and-devices)
- [http://freevideolectures.com/fiber optics](http://freevideolectures.com/fiber-optics)
- [http://nptel.ac.in/downloads/microwave engineering](http://nptel.ac.in/downloads/microwave-engineering)
- [http://nptel.ac.in/downloads/fiber optics](http://nptel.ac.in/downloads/fiber-optics)
- https://econtent.msbte.edu.in/econtent/econtent_home.php



ST. XAVIER'S TECHNICAL INSTITUTE

To Nurture the Joy of Excellence in the World of High Technology

CURRICULUM FOR DATA COMMUNICATION AND COMPUTER NETWORKING

Document Number: PBoS-2526-April-23504-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	DATA COMMUNICATION AND COMPUTER NETWORKING	MMM	VRR	SBG

EXECUTIVE SUMMARY

This course on **Data Communication and Computer Networking (23504)** is designed to provide students with a fundamental understanding of network architecture, communication protocols, and data transmission principles used in modern computer networks. The curriculum focuses on building conceptual clarity and analytical skills required for designing and evaluating networked systems.

The course begins with **Basic Network Concepts and Standards**, introducing fundamental networking terminology, network types, topologies, and standardization bodies that define communication protocols. It further covers **Networking Devices and Services**, explaining the role of routers, switches, hubs, gateways, and network services in enabling efficient data communication.

Students are then introduced to **Internetworking Models**, focusing on layered architectures such as OSI and TCP/IP models, which form the foundation for structured communication in computer networks. This helps learners understand how data moves across different layers in a networked environment.

The curriculum also emphasizes **Transmission Errors, Detection, and Correction**, enabling students to understand the causes of data errors during transmission and the techniques used for error detection and correction to ensure reliable communication.

Overall, the course provides a strong theoretical and practical foundation in computer networking, equipping students with essential skills to understand, analyze, and work with modern communication systems and network infrastructures.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Dr. Mahesh Munde	Subject Expert	
2	Mr. RakeshKumar Saroj	Subject Expert	

Program Title			Diploma in Electronics & Telecommunication Engineering														
Course Code			Course Title			DATA COMMUNICATION AND COMPUTER NETWORKING								Course Type		Semester	
23504														DSC		5	
Learning Scheme						Assessment Scheme											
Actual Contact Hrs./Week			SLH	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total	
CL	TL	LL				FA	SA	Total		FA		SA					
						Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
3	---	2	1	6	3	30	70	100	40	25	10	50	20	25	10	200	
1. Theory paper duration 3 hrs. 2. Theory paper assessment is Internal and External. 3. The assessment of Practical is Internal and External. 4. Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5. The assessment of Self Learning (SLA) is Internal.																	

RATIONALE:

This subject comes under the Application Technology group and students are intended to learn, understand, and apply the concepts. Data communication and computer networking is a crucial subject in the field of computer science and information technology. The subject forms the backbone of modern communication systems and enables the exchange of data and information between devices and systems. The prerequisite for this subject is digital communication subject which was taught in the preceding semester. The Key rationales for this subject are as follows: Foundation of Modern Computing, Connectivity, Hardware requirements and Compatibility, Basis of Internet, Emerging Technologies, Business Applications, Security Aspects, Career Opportunities, Problem-Solving Skills and Troubleshooting the network, Global Perspective, Innovation and Research.

COURSE OUTCOMES: --

Course theory content and practical skills will help student to Understanding of Networking Concepts, Ability to Design and Implement Networks, Knowledge of Network Protocols, Network Administration Skills, Network Security Awareness, Knowledge of Network Management, Application of Networking Concepts and Communication and Collaboration Skills.

Semester	5	Subject	DATA COMMUNICATION AND COMPUTER NETWORKING
CO 504	4 th Course in Third Year		
CO 504.1	Understand the network and its classification, protocol, and standards.		
CO 504.2	Identify the type of topology, medium, network connecting devices, switching types and categorize services.		
CO 504.3	Analyze functions of layers in the models and Investigate protocols in tool/s.		
CO 504.4	Classify errors and apply detection and correction codes to information/data		

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	DATA COMMUNICATION AND COMPUTER NETWORKING								
CO 504	4 th Course in Third Year								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CO 504.1	3	3	1	1	1	1	3	1	0
CO 504.2	3	3	2	3	2	2	3	2	1
CO 504.3	3	3	1	3	1	1	3	2	1
CO 504.4	3	3	2	2	2	2	3	0	0
CO TOTAL	12	12	06	09	06	06	12	5	2
CORRELATION LEVEL	3	3	1	2	1	1	3	1	0

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0, 1, 2, 3	4, 5, 6	7, 8, 9	10, 11, 12
CORRELATION LEVEL	0	1	2	3

	Section -- 1						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	BASIC NETWORK CONCEPTS AND STANDARDS						
1.1	Understanding Network – Basic Computer Network, Characteristics of Data Communication System, Components of Data Communication System, Data transmission and its types: Serial and Parallel Transmission, Synchronous and Asynchronous Transmission.	09	06	06	03	15	CO 504.1
1.2	Classification of Networks by their Geography: LAN, MAN, WAN and by their Functions: Peer-Peer network, Client- Server network.						
1.3	Communication Protocols and Standards: Elements of protocol, Classification of standards: De-facto & De-Jurie, Standards Organizations (ITU-T, ANSI, IEEE, IANA, ISO, FCC), IEEE protocols.						
2	NETWORKING DEVICES AND SERVICES						
2.1	Define Topology, Its types, Choice of Topology, Physical Topologies: Bus, Ring, Star, Mesh, Tree, Hybrid Topology; Comparative study of Topologies, Advantages & Limitations, Logical Topologies: Bus and Ring.	15	06	09	05	20	CO 504.2
2.2	Network Connecting devices: Network interface card (NIC), Hub, Switch, Repeaters and its types, Modem and its types, Bridges and its types, Router, B- routers.						
2.3	Types of Transmission Medium: Guided and Unguided: Co-axial, Twisted Pair, Fiber Optic Cables, Advantages and Limitations.						
2.4	Types of Switching: Circuit Switching, Message Switching and Packet Switching: Datagram and Virtual.						
2.5	Connectionless services & Connection- oriented services.						

	Section -- 2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
3	INTERNETWORKING MODELS						
3.1	OSI Reference Model: Need, Layered Architecture, Seven Layers of OSI, Peer-Peer Process, Interfaces between layers, Encapsulation of data.	15	06	06	08	20	CO 504.3
3.2	Functions of Seven Layers.						
3.3	Four Layers of TCP/IP Model, Protocols in TCP/IP: IPV4 Datagram Format, ARP, RARP, ICMP, IGMP, TCP, UDP, SCTP, FTP, SMTP, TELNET, HTTP.						
3.4	Addressing: Physical, Logical, Port Addresses, IP Addressing: Classful, Classless, Subnetting, Super netting, Properties of IP.						
3.5	Comparison of the OSI and TCP/IP reference models, TCP and UDP.						
4	TRANSMISSION ERRORS-DETECTION & CORRECTION						
4.1	Error Classification: Transmission Impairments: Distortion, Attenuation, Noise.	09	03	06	06	15	CO 504.4
4.2	Error Types: Single Bit, Multiple Bit, Burst Errors.						
4.3	Error Detection Codes: Vertical Redundancy Check; Longitudinal Redundancy Check, Cyclic redundancy check, Check Sum Method.						
4.4	Error Correction Code: Hamming Code.						
4.5	Numerical 's on above Error Detection and Error Correction methods.						

IMPLEMENTATION STRATEGY:

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet (for teachers as well as students)
- 3) Extensive use of examples and simulators
- 4) Group discussions and micro project
- 5) Assignments for writing skills, create awareness about selection /purchasing Components

LIST OF LABORATORY EXPERIENCES

EXP. NO.	TITLE	COURSE OUTCOME	CHAPT. NO.
1.	Preparation of LAN cable	CO 504.2	2
2.	Installation of client operating system and application	CO 504.1	1
3.	Installation of windows server operating system and application	CO 504.1	1
4.	Installation of Linux server operating system and application	CO 504.1	1
5.	Sharing resources across LAN	CO 504.2	2
6.	Configuring Basic commands on Router	CO 504.2	2
7.	Configuring Basic commands on Switch	CO 504.2	2
8.	Configuring Router Interfaces	CO 504.3	3
9.	Configuring Routing Protocol	CO 504.3	3
10.	Configuring Authentication for Security	CO 504.4	4

IMPLEMENTATION STRATEGY

1. Teaching plan
2. Minimum 8 practical's

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, 9,and so on.....)

LAB EXPERIENCE		1	2	3	4	5	6
	COURSE OUTCOMES	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)
STUDENT SPNO							
2303001							
2303002							
2303003							

* The final % attainment level for TERM WORK of each course outcome is computed and the overall % attainment level for the course, for term work is calculated.

SUGGESTED LIST OF MICROPROJECTS FOR SELF LEARNING

Micro projects could be individual or group based activity. A suggestive list is given here, similar micro projects could be added by concerned faculty. Each student will maintain work carried out in diary with details of individual contribution. Assessment is done by theory teacher based on their working or understanding level of the project during submission.

SR. NO.	TITLE
1.	Installation of Domain Controller and applying policies
2.	Preparation of Coaxial Cable/ FOC cable for network (10-50 meters)
3.	Packet Sniffing: Understanding Data Transmission Dynamics
4.	Network Traffic Analysis: Insights into Data Flow Patterns
5.	Ethernet vs. Wi-Fi: Comparative Performance Analysis
6.	TCP/IP Protocol Suite: Implementation and Analysis
7.	Secure Communication Protocols: A Study on SSL/TLS
8.	Network Performance Optimization: QoS and Bandwidth Management"
9.	IPv4 vs. IPv6: Evolution and Comparative Analysis
10.	Wireless Networking: Challenges and Solutions
11.	Network Security: Vulnerability Assessment and Countermeasures
12.	Cloud Networking: Architecture and Deployment Strategies

SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Chapter No.	Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	Section I					
1	BASIC NETWORK CONCEPTS AND STANDARDS	09	06	06	03	15
2	NETWORKING DEVICES AND SERVICES	15	06	09	05	20
	Section II					
3	INTERNETWORKING MODELS	15	06	06	08	20
4	TRANSMISSION ERRORS-DETECTION & CORRECTION	09	03	06	06	15
	Total	48	21	27	22	70
	Legends:: R :-- Remember , U :-- Understand , A :--Application					

This specification table provides guidelines to teacher/s to teach & assess students, also a general guideline to frame theory exam paper which student have to undertake. The actual distribution of marks at different taxonomy level in the question paper may vary from above table depending upon the paper setters views.

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	Behrouz A. Forouzan	Data Communications and Networking	5th	2022	McGraw Hill, New Delhi
2.	William Stallings	Computer Networks	7th	2022	McGraw Hill, New Delhi
3.	Andrew S. Tanenbaum	Computer Networks	5th	2010	McGraw Hill, New Delhi
4	Achyut S. Godbole	Data Communication & Networking	4th	2022	Tata McGraw-Hill

LEARNING WEBSITES / WEB REFERENCES :

- **Cisco Networking Academy:** Offers comprehensive courses on networking, including networking fundamentals, routing, and switching, security, and more. (<https://www.netacad.com/>)
- **Coursera:** Provides online courses from universities and organizations on various aspects of networking, including introductory courses and specialized topics. (<https://www.coursera.org/>)
- **edX:** Offers courses from universities and institutions worldwide, covering topics like computer networking, network security, and wireless communication. (<https://www.edx.org/>)
- **Khan Academy:** Provides free courses and tutorials on computer networking basics and related topics. (<https://www.khanacademy.org/computing>)
- **Cybrary:** Offers free and paid courses on networking, cybersecurity, and IT infrastructure, including hands-on labs and certifications. (<https://www.cybrary.it/>)
- **YouTube:** Some popular channels include Network Chuck, David Bombal, and Eli the Computer Guy.
- **Networking-Forums.com:** A community-driven forum where networking professionals discuss various networking topics, share knowledge, and seek help. (<https://networking-forums.com/>)
- **Tech Target Search Networking:** Provides articles, tutorials, and resources on networking technologies, trends, and best practices. (<https://searchnetworking.techtarget.com/>)
- **Cisco DevNet:** Offers learning labs, sandboxes, and resources for developers and network engineers to learn about Cisco technologies and APIs. (<https://developer.cisco.com/>)
- **The Wireshark Network Protocol Analyzer:** Provides documentation, tutorials, and resources for learning about network protocol analysis using Wireshark. (<https://www.wireshark.org/>)
- https://econtent.msbt.edu.in/econtent/econtent_home.php



ST. XAVIER'S TECHNICAL INSTITUTE

To Nurture the Joy of Excellence in the World of High Technology

CURRICULUM FOR ADVANCED POWER ELECTRONICS

Document Number: PBoS-2526-April-23505-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	ADVANCE POWER ELECTRONICS	VRR	AAP	SBG

EXECUTIVE SUMMARY

This course on **Advanced Power Electronics (23505)** is designed to provide students with in-depth knowledge of modern power conversion techniques, advanced semiconductor devices, and industrial power applications. The curriculum focuses on enhancing understanding of high-performance power electronic systems used in modern electrical engineering.

The course begins with **Modern Power Devices and Protection Circuits**, introducing advanced semiconductor devices, their operating principles, and protection mechanisms used to ensure safe and reliable operation in power electronic systems. It further covers **DC to DC Converters**, enabling students to understand efficient voltage conversion techniques and switching regulator topologies used in power supply systems.

Students are then introduced to **Multilevel Inverters**, focusing on advanced inverter configurations used for high-power and high-efficiency AC output generation with improved waveform quality. The curriculum also includes **AC Voltage Stabilizers and Uninterruptible Power Supplies (UPS)**, explaining voltage regulation techniques and backup power systems essential for continuous and stable power delivery.

Finally, the course covers **Electric Drives and Industrial Applications**, highlighting the role of power electronics in controlling electric machines, automation systems, and various industrial processes.

Overall, the course provides a strong theoretical and application-oriented foundation in advanced power electronics, equipping students with the skills required to design, analyze, and implement modern power conversion and control systems in industrial environments.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Dr. Vijay Rathod	Subject Expert	
2	Mr. Abhijit Patil	Subject Expert	

Program Title			Diploma in Electronics & Telecommunication Engineering																
Course Code			Course Title			ADVANCE POWER ELECTRONICS										Course Type		Semester	
23505																DSE		5	
Learning Scheme						Assessment Scheme													
Actual Contact Hrs./Week			SLH	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total			
CL	TL	LL				FA	SA	Total		FA		SA							
								Max	Min	Max	Min	Max	Min	Max	Min				
3	---	2	1	6	3	---	---	---	---	25	10	50	20	25	10	100			
	1. Theory paper duration 3 hrs. 2. Theory paper assessment is Internal and External. 3. The assessment of Practical is Internal and External. 4. Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5. The assessment of Self Learning (SLA) is Internal.																		

RATIONALE:

This subject comes under the Application Technology group and students are intended to learn, understand, and apply the concepts. The subject forms the backbone of modern electronics systems.

COURSE OUTCOMES: --

Course theory content and practical skills will help student to Understanding of power electronics concepts, Ability to Design and Implement Networks, Knowledge of Network systems.

Semester	5	Subject	ADVANCE POWER ELECTRONICS
CO 505		5 ^h Course in Third Year	
CO 505.1		Select relevant protection circuit for different power electronics devices.	
CO 505.2		Use DC-DC converters for different quadrant applications.	
CO 505.3		Analyze the performance of multilevel inverters.	
CO 505.4		Evaluate the performance parameters of voltage stabilizer and uninterrupted power supply.	
CO 505.5		Maintain electric drives used in various industrial applications.	

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	ADVANCE POWER ELECTRONICS								
	5 th Course in Third Year								
CO 505	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CO 505.1	3	3	1	1	1	1	3	3	1
CO 505.2	3	3	2	3	2	2	3	3	3
CO 505.3	2	2	1	3	1	1	3	2	2
CO 505.4	2	2	2	1	2	2	3	3	2
CO 505.5	2	2	---	1	---	2	---	2	1
CO TOTAL	12	12	06	10	06	08	12	13	7
CORRELATION LEVEL	3	3	1	3	1	2	3	3	2

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0, 1, 2, 3	4, 5, 6	7, 8, 9	10, 11, 12
CORRELATION LEVEL	0	1	2	3

	Section -- 1						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	MODERN POWER DEVICES AND PROTECTION CIRCUITS						
1.1	SIT, MCT and FCT Power devices: Symbol, construction, working, V-I characteristics and applications.	10					CO 505.1
1.2	di/dt protection circuit and snubber circuit.		---	---	---	---	
1.3	dv/dt protection circuit and snubber circuit.						
1.4	Thermal Protection of SCR: Need, thermal resistance and heat sinks specification.						
2	DC TO DC CONVERTERS						
2.1	Function of Chopper, types, control strategies of chopper: constant frequency and variable frequency system.	14					CO 505.2
2.2	Classification of choppers on the basis of Quadrant operation.						
2.3	Chopper Circuit diagram using MOSFET, mode of operation, wave forms: First-quadrant (Type-A), Second-quadrant (Type-B), Type-C (Two-quadrant Type-a), Type-D (Two-quadrant Type-b), Four-quadrant (Type-E).		---	---	---	---	
2.4	SMPS: Fly back converter, Push pull converter.						

	Section -- 2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
3	MULTI LEVEL INVERTERS						
3.1	Inverter-Concept, types-Voltage Source Inverter (VSI) and Current Source Inverter (CSI).	8	---	---	---	---	CO 505.3
3.2	Single phase CSI - Working with ideal switches and waveforms (R load).						
3.3	Three phase bridge voltage source inverter: 180° mode 120° mode – Working with ideal switches and waveforms (R load).						
3.4	Pulse width modulation: need, types: Sinusoidal Pulse Width Modulation (SPWM), Multiple Pulse Width Modulation (MPWM), SPWM: concept, working principle and waveforms.						
4	AC VOLTAGE STABILIZER AND UNINTERRUPTABLE POWER SUPPLY						
4.1	Stabilizer: Need, definition, classification, basic block diagram, applications.	8	---	---	---	---	CO 505.4
4.2	Types of stabilizers: Relay type, Servo type, static voltage.						
4.3	Stabilizer: Circuit diagram, Working, advantages, disadvantages and applications.						
4.4	UPS specification: features of On- line and Off-line UPS Specifications Input Voltage Range, DC Voltage Range, Transient Response, Response Time, Total Harmonic Distortion, output frequency, output waveforms, Transient Recovery, load power factor and types of Protection circuit.						
4.5	Rechargeable Batteries – Classification- Lithium-Ion (Li-Ion) battery, Lithium Nickel Manganese Cobalt Oxide (NMC) and Lithium Nickel Cobalt Aluminum Oxide (NCA). Specification: back up time, power rating, and transfer time.						
5	ELECTRIC DRIVES AND INDUSTRIAL APPLICATIONS						
5.1	Variable frequency drives (VFD): Need, Block diagram, working principle, Advantages, disadvantages and its applications.	8	---	---	---	---	CO 505.5
5.2	Charge controller: Concept, types, applications in Photovoltaics (PV), system with block diagram with focus on inverter.						
5.3	AC to AC converter using DC link: Concept, applications in Wind Power Generation and with focus on VFD.						
5.4	Electrical vehicle (EV)- Plug-in Electrical vehicle (PEV) and Plug in Hybrid electric vehicle (PHEV): Block diagram, function of each block with focus on Drive mechanism and applications.						

IMPLEMENTATION STRATEGY:

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet (for teachers as well as students)
- 3) Extensive use of examples and simulators
- 4) Group discussions and micro project
- 5) Assignments for writing skills, create awareness about selection /purchasing Components

LIST OF LABORATORY EXPERIENCES

EXP. NO.	TITLE	COURSE OUTCOME	CHAPT. NO.
1.	Protection circuit for SCR based on dv/dt method.	CO 505.1	1
2.	Simulation of Type-A chopper (Power MOSFET based) circuit using MATLAB Simulink / SCILAB / relevant software.	CO 505.2	2
3.	Simulation of Type-E chopper (Power MOSFET based) circuit using MATLAB Simulink/SCILAB / relevant software Simulation of input output voltage of Buck-Boost Converter Circuit by varying duty ratio using MATLAB Simulink / SCILAB / relevant software.	CO 505.2	2
4.	Simulation of 180-degree mode and 120-degree mode of three Phase Voltage Source Inverter Circuit using MATLAB Simulink / SCILAB / relevant software.	CO 505.2	2
5.	Simulation of sinusoidal PWM Waves using MATLAB Simulink / SCILAB / relevant software	CO 505.3	3
6.	Simulation of input output voltage of Buck-Boost Converter Circuit by varying duty ratio using MATLAB Simulink /SCILAB /relevant software.	CO 505.3	3
7.	Measurement of voltages at different test points and verify specifications of UPS with the datasheet.	CO 505.4	4
8.	Measurement of the output voltage for servo type voltage stabilizer for different values of ac input voltage.	CO 505.4	4
9.	Test Performance of lithium-ion battery.	CO 505.5	5
10.	Test the performance of Charge controller in PV System.	CO 505.5	5

IMPLEMENTATION STRATEGY

1. Teaching plan
2. Minimum 8 practical's

The table to measure the attainment levels for TERM WORK (on a rating scale of "out of 25") of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, 9,and so on.....)

LAB EXPERIENCE		1	2	3	4	5	6
	COURSE OUTCOMES	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)
STUDENT SPNO							
2303001							
2303002							
2303003							

* The final % attainment level for TERM WORK of each course outcome is computed and the overall % attainment level for the course, for term work is calculated

SUGGESTED LIST OF MICROPROJECTS FOR SELF LEARNING

Micro projects could be individual or group based activity. A suggestive list is given here, similar micro projects could be added by concerned faculty. Each student will maintain work carried out in diary with details of individual contribution. Assessment is done by theory teacher based on their working or understanding level of the project during submission.

TITLE	
• Develop a Battery Management System (BMS) for lithium-ion or other rechargeable batteries, focusing on monitoring and balancing the cells to extend battery life and ensure safety.. (Components: Voltage and temperature sensors Balancing circuitry (resistive or active) Microcontroller or dedicated BMS IC • Design a DC-DC converter circuit to efficiently step up (boost) or step down (buck) voltage levels for a specific application, such as powering a microcontroller or LED system. • Develop a small solar-powered lighting system for use in gardens, pathways, or emergency lighting. (Components: PV panel (appropriate size for the desired lighting output) LED lights Rechargeable battery (e.g., Li-ion or NiMH) Charge controller (or a simple battery protection circuit) Light sensor (optional, for automatic control)) • Develop a portable solar-powered USB charger for charging small electronic devices such as smartphones or tablets (Components: PV panel (with enough output to charge devices) DC-DC converter (to step up voltage to 5V USB standard) USB output module Rechargeable battery (optional, for storing energy)) • Build a small, solar-powered fan for ventilation in areas like small rooms or greenhouses (Components: Small PV panel (sufficient to power a DC fan) DC fan (12V or 5V) Battery for energy storage (optional for continuous operation) Basic DC-DC converter (if needed to match voltage requirements))	

SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Chapter No.	Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
Section I						
1	MODERN POWER DEVICES AND PROTECTION CIRCUITS	10	---	---	---	---
2	DC TO DC CONVERTERS	14	---	---	---	---
Section II						
3	MULTI LEVEL INVERTERS	8	---	---	---	---
4	AC VOLTAGE STABILIZER AND UNINTERRUPTABLE POWER SUPPLY	8	---	---	---	---
5	ELECTRIC DRIVES AND INDUSTRIAL APPLICATIONS	8	---	---	---	---
Total		48	---	---	---	---

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	Muhammad H. Rashid	Power Electronics: Devices, Circuits, and Applications	4 th	2000	Pearson Education
2.	M D Singh K B Khanchandani	Power Electronics	4 th	2020	McGraw Hill, New Delhi
3.	P. S. Bimbhra	Power Electronics	5 th	2010	Khanna Publisher, New Delhi
4	Madhukar Waware, D. S. More, Vijay Mohale, Abhay Wagh	Power Electronics and Its Applications	2 nd	2022	Khanna Publisher, New Delhi

LEARNING WEBSITES / WEB REFERENCES :

- <https://afdc.energy.gov/fuels/electricity-research>
- <https://nptel.ac.in/courses/108102145>
- <https://www.youtube.com/watch?v=VbrQVcrVcmc>
- https://econtent.msbte.edu.in/econtent/econtent_home.php



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CURRICULUM FOR INDUSTRIAL MANAGEMENT

Document Number: PBoS-2526-April-23506-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	INDUSTRIAL MANAGEMENT	AAP	VRR	SBG



EXECUTIVE SUMMARY

This course on **Industrial Management (23506)** is designed to provide students with fundamental knowledge of managerial principles and supervisory-level practices essential for efficient industrial operations. The curriculum focuses on developing organizational, leadership, and decision-making skills relevant to technical and industrial environments.

The course begins with **Principles and Techniques of Management**, introducing core management concepts, functions, and modern techniques used for effective resource utilization and productivity improvement. It further covers **Planning and Organizing at Supervisory Level**, enabling students to understand workflow structuring, resource allocation, and coordination of industrial activities.

Students are then introduced to **Directing and Controlling at Supervisory Level**, focusing on leadership roles, communication, motivation, performance monitoring, and corrective actions required for achieving organizational goals.

The curriculum also emphasizes **Safety Management**, highlighting workplace safety practices, hazard identification, risk mitigation, and implementation of safety standards in industrial settings.

Finally, the course includes **Legislative Acts**, providing awareness of relevant industrial laws, labour regulations, and compliance requirements governing workplace operations.

Overall, the course equips students with essential managerial and supervisory competencies, integrating technical understanding with organizational skills to enhance efficiency, safety, and compliance in industrial environments.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Dr. Shivaji Ghungrad	Subject Expert	
2	Mr. Abhijit Patil	Subject Expert	

Program Title				Diploma in Electronics & Telecommunication Engineering														
Course Code			Course Title			INDUSTRIAL MANAGEMENT										Course Type		Semester
23506																SEC		5
Learning Scheme						Assessment Scheme												
Actual Contact Hrs./Week			SLH	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total		
CL	TL	LL				FA	SA	Total		FA		SA						
			Max	Min				Max	Min	Max	Min	Max	Min					
3	---	---	3	6	3	30	70	100	40	---	---	---	---	50	20	150		
	1. Theory paper duration 3 hrs. 2. Theory paper assessment is Internal and External. 3. The assessment of Practical is Internal and External. 4. Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5. The assessment of Self Learning (SLA) is Internal.																	

RATIONALE:

This course aims to provide students with foundational and applied knowledge in areas such as operations management, supply chain logistics, quality control, production planning, and human resource management. By integrating principles of engineering with management practices, the course prepares students to make data-driven decisions, implement lean manufacturing, and contribute to strategic organizational goals.

Students of this course will be well-positioned for supervisory roles in manufacturing, logistics, service operations, and technology-driven enterprises, where efficient management of resources and innovation is vital.

COURSE OUTCOMES:--

Course theory content, practical skills, experience help student to understand, learn industrial management terms & networks acts methodologies of functions in industry, thus student should be able to achieve the following course outcomes.

Semester	5	Subject	INDUSTRIAL MANAGEMENT
CO 506	6 th Course in Second Year		
CO 506.1	Analyze the concept of Management		
CO 506.2	Differentiate between Administrations and organizations		
CO 506.3	Analyze the concept of planning and organizing		
CO 506.4	Analyze the need of Directing and Controlling		
CO 506.5	Identify the Safety norms		
CO 506.6	Implement of Legislative Acts		

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	INDUSTRIAL MANAGEMENT								
	6th Course in Third Year								
CO 506	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CO 506.1	3	2	2	1	2	3	2	1	0
CO 506.2	3	2	2	0	1	2	2	1	0
CO 506.3	3	2	2	0	2	2	1	1	0
CO 506.4	3	3	3	1	2	3	2	2	0
CO 506.5	3	2	2	1	2	2	1	1	0
CO 506.6	3	2	1	0	3	2	2	0	0
CO TOTAL	18	13	12	3	12	14	10	06	0
CORRELATION LEVEL	3	2	2	1	2	2	2	1	0

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0, 1, 2	3, 4, 5, 6, 7, 8	9, 10, 11, 12, 13, 14	15, 16, 17, 18
CORRELATION LEVEL	0	1	2	3

	Section -- 1						
Chapter No	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	PRINCIPLES AND TECHNIQUES OF MANAGEMENT						
1.1	Definitions of management, role and importance of management.	12	06	06	06	18	CO 506.1 CO 506.2
1.2	Management characteristics and principles, levels of management and their functions; Management, administration and organization, relation between management and administration.						
1.3	Functions of management: planning, organizing, leading/directing, staffing and controlling.						
1.4	Types of planning and steps in planning.						
1.5	Types of organization, steps in organizing.						
1.6	Functional areas of management.						
1.7	Managerial skills.						
2	PLANNING AND ORGANIZING AT SUPERVISORY LEVEL						
2.1	Planning by supervisor.	08	05	06	06	17	CO 506.3
2.2	Planning activities, detailing and following of each step.						
2.3	Prescribing standard forms for various activities.						
2.4	Budgeting for materials and manpower.						
2.5	Organizing the physical resources.						
2.6	Matching human need with job needs.						
2.7	Allotment of task to individuals and establishing relationship among persons working in a group.						

	Section -- 2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
3	DIRECTING AND CONTROLLING AT SUPERVISORY LEVEL						
3.1	Needs for directions and instructions to subordinates; Completeness and feasibilities of instructions.	08	04	04	03	11	CO 506.4
3.2	Personal counselling advanced predictions of possible mistakes.						
3.3	Elaborating decision, laying disciplinary standards in overall working.						
3.4	Managerial control Understanding team and link between various departments in respect to process and quality standards; Steps in control process.						
3.5	Controlling methods; control over the performance in respect of quality, quantity of production, time and cost. Measuring performance, correcting unfavorable deviations.						
4	SAFETY MANAGEMENT						
4.1	Need for safety management measures.	08	04	04	04	12	CO 506.5
4.2	General Safety norms for an industrial unit; Preventive measures.						
4.3	Definition of accident, types of industrial accident, Causes of accidents.						
4.4	Fire hazards; Fire drill.						
4.5	Safety procedure, Work permits.						
5	LEGISLATIVE ACTS						
5.1	Necessity of acts, Important definition and Main provisions of acts.	08	04	04	04	12	CO 506.6
5.2	Industrial Acts:						
5.2.1	Indian Factory Act.						
5.2.2	Industrial Dispute Act.						
5.2.3	Workman Compensation Act.						
5.2.4	Minimum Wages Act.						

IMPLEMENTATION STRATEGY:

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet **(for teachers as well as students)**
- 3) Extensive use of examples
- 4) Group discussions and micro project
- 5) Assignments for writing skills, create awareness about selection /purchasing components

SUGGESTED LIST OF MICROPROJECTS FOR SELF LEARNING

Micro project could be group based. A suggestive list is given here, similar micro projects could be added by concerned faculty. Each student will maintain dated work diary with details of individual contribution. Assessment is done by project guide based on their performance and presentation of submission.

SR. NO.	TITLE
1	Study of management principles applied to a small scale industry.
2	Study of management principles applied to a medium scale industry.
3	Study of management principles applied to a large scale industry.
4	Prepare case studies of Safety measures followed in different types of organization.
5	Study of measures to be taken for ensuring cyber security.

SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Chapter No.	Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
	Section I					
1	PRINCIPLES AND TECHNIQUES OF MANAGEMENT	12	06	06	06	18
2	PLANNING AND ORGANIZING AT SUPERVISORY LEVEL	08	05	06	06	17
	Section II					
3	DIRECTING AND CONTROLLING AT SUPERVISORY LEVEL	08	04	04	03	11
4	SAFETY MANAGEMENT	08	04	04	04	12
5	LEGISLATIVE ACTS	12	02	06	04	12
	Total	48	21	26	23	70
	Legends :: R ::- Remember , U ::- Understand , A ::-Application					

This specification table provide guide line to teacher to teach & assess student also a general guideline to frame theory paper & practical theory exam paper which student have to undertake. The actual distribution of marks at different taxonomy level in the question paper may vary from above table.

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	Dr. O.P Khanna	Industrial Engineering & Management	1st	1999	Dhanpat rai& publications
2.	Veerabhadra and, Havinal	Management and Entrepreneurship	1st	2014	New age international publishers

LEARNING WEBSITES / WEB REFERENCES :

- <https://www.griet.ac.in/> case study
- <https://sctevtodisha.nic.in/wp-content/plugins/LectureNote>
- <https://www.youtube.com/>
- https://econtent.msbte.edu.in/econtent/econtent_home.php



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CURRICULUM FOR CAPSTON PROJECT

Document Number: PBoS-2526-April-23507-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	CAPSTON PROJECT	SRB	VRR	SBG



EXECUTIVE SUMMARY

The **Capstone Project (23507)** is designed as a culminating academic experience that enables students to integrate and apply the knowledge, skills, and competencies acquired throughout their diploma program. It provides a structured platform for experiential learning through the resolution of open-ended, real-world, and interdisciplinary engineering problems.

The project reinforces previously acquired technical and domain-specific skills, enabling students to transition from fundamental learning to higher-order application and synthesis of knowledge. It emphasizes the development of competencies and confidence required to analyze and solve complex, real-life engineering challenges.

The Capstone Project also fosters critical thinking, systematic planning, and informed decision-making while encouraging creativity and innovation in proposing multiple solution approaches. Students are exposed to a challenging, task-oriented learning environment that promotes exploration of alternative design and implementation strategies.

In addition, the project experience strengthens students' ability to work within defined timeframes and resource constraints, thereby enhancing project management capabilities and professional discipline. Team-based execution further develops collaboration, communication, and coordination skills essential for industry readiness.

Overall, the Capstone Project serves as an integrative learning experience that bridges academic knowledge with practical application, preparing students for professional roles by cultivating technical proficiency, problem-solving ability, and teamwork orientation.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Mr. Sanjiv Borkar	Subject Expert	
2	Dr. Mahesh Munde	Subject Expert	

Program Title			Diploma in Electronics & Telecommunication Engineering																
Course Code			Course Title			CAPSTON PROJECT										Course Type		Semester	
23507																INP		5	
Learning Scheme						Assessment Scheme													
Actual Contact Hrs./Week			SLH	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total			
CL	TL	LL				FA	SA	Total		FA		SA							
								Max	Min	Max	Min	Max	Min	Max	Min				
---	---	4	---	4	2	---	---	---	---	50	20	100	40	---	---	150			
	1. Theory paper duration 3 hrs. 2. Theory paper assessment is Internal and External. 3. The assessment of Practical is Internal and External. 4. Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5. The assessment of Self Learning (SLA) is Internal.																		

RATIONALE:

Project is classified under Applied Technology courses. In continuation to the Project work started by the student in the fifth semester, he/she has to meet the set goals of testing, finalization and completion before the end of the fifth semester. Project work is supposed to be largely a student-centered activity. It is a purposeful student activity which is supposed to be planned, designed and performed by a student or a group of students, which ultimately will help them to accomplish higher level cognitive and affective domain activities. It will also help them to achieve psychomotor objectives. The objective of the project work undertaken is to reinforce and integrate previously acquired lower sub-skills and attitudes within a branch and slowly transform them into higher level skills. It will help to develop competencies and confidence to solve open and real-life interdisciplinary problems. Project work is supposed to develop thinking, planning and decision-making skills with ample scope for using creativity. It presents a challenging and task-oriented learning environment with optional solutions, besides developing ability and confidence in accomplishing targets with given time and resources constraints. It is also meant to develop higher level interactive skills and ability of working in teams.

COURSE OUTCOMES: --

Course theory content and practical skills will help student to Understanding of Networking Concepts, Ability to Design and Implement knowledge of Management, Application of Networking Concepts and Communication and Collaboration Skills.

Semester	5	Subject	CAPSTON PROJECT
CO 507		7 th Course in Third Year	
CO 507.1		Reinforce and integrate previously acquired lower sub-skills and attitudes within a branch and slowly transform them into higher level skills.	
CO 507.2		Develop competencies and confidence to solve open and real-life interdisciplinary problems.	
CO 507.3		Develop thinking, planning and decision-making skills with ample scope for using creativity.	
CO 507.4		Present a challenging and task-oriented learning environment with optional solutions.	
CO 507.5		Develop confidence in accomplishing targets with given time and resources constraints and work as a team.	

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	CAPSTON PROJECT								
	7th Course in Third Year								
CO 507	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CO 507.1	3	2		2	3	3	3	2	2
CO 507.2	3	2		2	3	3	3	3	3
CO 507.3	3	2		2	3	3	3	3	3
CO 507.4	3	2		2	3	3	3	3	3
CO 507.5	3	2		2	3	3		3	3
CO TOTAL	15	10	0	10	15	15	12	14	15
CORRELATION LEVEL	3	3	0	3	3	3	3	3	3

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0, 1, 2, 3	4, 5, 6, 7	8, 9, 10, 11	12, 13, 14, 15
CORRELATION LEVEL	0	1	2	3

OBJECTIVES/ CRITERIA FOR ASSESSMENT:

The students will be able to do the following in relation to the “translation” of the expected course outcomes specified in the table above. It should be observed and evaluated by the concerned teacher whether the students do the following **during practical time**:

- 1) Apply and expand upon the previous knowledge gained in earlier semesters.
- 2) Work with confidence on PCB's, soldering/ de-soldering, testing of circuit, etc.
- 3) Make logical decisions pertaining to requirements of project.
- 4) Solve problems faced during the design and building and testing phases of project.
- 5) Work with confidence and in a timely manner, and work as a team together.

The course outcome attainment levels are to be evaluated on a regular basis for the **TERM WORK**, based on the student **commitment, interaction and activity, as defined in and stated above in the corresponding objectives/ criteria, during the practical time** allotted to them for the **PROJECT WORK**. This is for **TERM WORK** of 50 marks. The table represents a measure of the attainment levels (on a rating scale of “out of 50”) through observation of performance of students in relation to the “translation” of the course outcomes is as listed above. Besides this **ATTENDANCE** is to be used as a reference - If **ATTENDANCE** or **STUDENT INTERACTION/ INTEREST** is not satisfactory (as in remarks column provided) **TERM WILL NOT BE GRANTED**

	OBJECTIVES/ CRITERIA	C314.1 (out of 50)	C314.2 (out of 50)	C314.3 (out of 50)	C314.4 (out of 50)	C314.5 (out of 50)	REMARKS	% ABSENT
STUDENT SPNO								
2303001								
2303002								
2303003								

* The final average % attainment level of course outcomes for the course, for term work may then be calculated.

* The course outcomes attainment levels for the **ORAL EXAMINATION** should be based on their **ACTUAL PROJECT, PROJECT REPORT, PRESENTATION OF THE SAME, and RESPONSES** given during the oral examination. This is for the **ORAL EXAMINATION** of 50 marks.

CONTENTS		
Sr. No.	Name of the Topic	Periods
1	ANALYSIS	
1.1	Electronics/Software Requirement Specification, Enhancement Model, Role of Management in Electronics/Software Development,	10
1.2	Role of Metrics and Measurement, Problem Analysis, Requirement Specification, Validation, Metrics, Monitoring and Control.	
2	DESIGN	
2.1	Problem Partitioning, Abstraction, Design, specification & verification, metrics, Monitoring & Control	12
3	TESTING, MAINTENANCE & IMPLEMENTATION OF THE SELECTED PROJECT	
3.1	Levels of Testing- Functional Testing, Structural Testing, Test Plan, Test Cases Specification, Reliability assessment.	10
3.2	Project Management, Cost Estimation, Project Scheduling, Electronics/Hardware/Software Configuration Management, Quality Assurance, Project Monitoring, Risk Management.	

INSTRUCTIONS:

1. The typed project report must be bound and submitted by each student before the end of the term.
2. One extra copy of the project report per batch must be submitted to the examiner.

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	Walter C. Bosshart	Printed Circuit Board Design and Technology	1st	1983	Mc Graw Hill, International

Program Title			Diploma in Electronics & Telecommunication Engineering														
Course Code			Course Title			INTRODUCTION TO GREEN TECHNOLOGIES								Course Type		Semester	
23508														GE		5	
Learning Scheme						Assessment Scheme											
Actual Contact Hrs./Week			SLH	L/H	CREDITS	THEORY				PRACTICAL				SLA		Total	
CL	TL	LL				FA	SA	Total		FA		SA					
								Max	Min	Max	Min	Max	Min	Max	Min		
2	---	2	2	6	3	---	---	---	---	50	20	---	---	50	20	100	
1) Theory paper duration 3 hrs. 2) Theory paper assessment is Internal and External. 3) The assessment of Practical is Internal and External. 4) Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5) The assessment of Self Learning (SLA) is Internal.																	

RATIONALE:

Introduction to Green Technology is an introductory science course that prepares students for further. Learning in the emerging engineering fields of green technologies, environmental technology, and Renewable energy forms.

COURSE OUTCOMES: --

Semester	5	Subject	INTRODUCTION TO GREEN TECHNOLOGIES
CO 508	8th Course in Third Year		
CO 508.1	Introduce the concept of Green Technology.		
CO 508.2	Impart the Knowledge of Carbon emission.		
CO 508.3	Introduce the concept of Life cycle Assessment		
CO 508.4	Learn the importance of green fuels and its impact on environment		

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	INTRODUCTION TO GREEN TECHNOLOGIES								
CO 508	8th course in Third Year								
CO 508	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CO 508.1	1	1	--	--	3	--	2	2	1
CO 508.2	1	2	2	--		--	--	1	--
CO 508.3	--	2	--	--	2	--	1	1	--
CO 508.4	1	--	2	--	3	--	--	3	1
CO TOTAL	3	5	4	--	8	--	3	7	2
CORRELATION LEVEL	1	1	0	1	1	0	1	1	0

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0, 1, 2	3, 4, 5, 6, 7, 8	9, 10, 11, 12, 13, 14	15, 16, 17, 18
CORRELATION LEVEL	0	1	2	3

	Section – 1						
Chapter No	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	INTRODUCTION TO GREEN TECHNOLOGY						
1.1	Definition and its importance.	04	---	---	---	---	CO 508.1
1.2	Principles of Green Technology.						
1.3	Advantages and disadvantages of green technologies.						
1.4	Factors affecting green technologies.						
1.5	Role of industry, Government and institution.						
1.6	Introduction to industrial Ecology and role of industrial ecology in green Technology.						
2	CLEANER PRODUCTION						
2.1	Definition and its Importance.	06	---	---	---	---	CO 508.2
2.2	Principles and its benefits.						
2.3	Role of industry, Government and institution in cleaner production.						
2.4	Clean development mechanism.						
2.5	Reuse, Recovery, Recycle.						
2.6	Raw material substitution- Wealth from waste.						
3	CP AWARENESS AND LIFE CYCLE ASSESSMENT (LCA)						
3.1	Pollution prevention and cleaner production awareness plan.	06	---	---	---	---	CO 508.3
3.2	Waste audit.						
3.3	Environmental statements.						
3.4	Carbon credit and carbon trading.						
3.5	Introduction to LCA and elements of LCA.						

	Section - 2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
4	ENERGY SOURCES						
4.1	Availability and need of conventional energy resources,	08	---	---	---	---	CO 508.4
4.2	Major environmental problems related to conventional energy resources,						
4.3	Future possibilities of energy need and availability.						
5	GREEN FUELS						
5.1	Definition of green fuels.	08	---	---	---	---	CO 508.5
5.2	Benefits and challenges.						
5.3	Comparison of green fuel with conventional fossil fuels with reference to environmental, economic and social impact.						
5.4	Public policies and market driven initiatives.						

IMPLEMENTATION STRATEGY:

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet **(for teachers as well as students)**
- 3) Extensive use of examples
- 4) Group discussions and micro project

LIST OF LABORATORY EXPERIENCES

EXP. NO.	TITLE	COURSE OUTCOME	CHAPT. NO.
1.	Definition of Green technology, its importance and advantages and disadvantages.	CO 508.1	1
2.	Role of industrial ecology in Green technology.	CO 508.1	1
3.	Principles of Cleaner production and its benefits.	CO 508.2	2
4.	Clean development mechanism, wealth from waste.	CO 508.2	2
5.	Carbon credit and carbon trading.	CO 508.3	3
6.	Introduction to LCA and its elements.	CO 508.3	3
7.	Comparison of conventional and non-conventional energy sources.	CO 508.4	4
8.	Device and technology used in solar energy conversion.	CO 508.4	4
9.	Green fuels, their benefits and challenges.	CO 508.5	5
10.	Concept of biomass energy utilization, types of biomass.	CO 508.4	4
11.	Suitability of wind, tidal and geothermal energy in Indian context.	CO 508.4	4

IMPLEMENTATION STRATEGY

1. Teaching plan
2. Minimum 10 practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, 9,and so on.....)

LAB EXPERIENCE		1	2	3	4	5	6
COURSE OUTCOMES		C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)
STUDENT SPNO							
2303001							
2303002							
2303003							

*The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.

SUGGESTED LIST OF MICROPROJECTS

SR. NO.	TITLE
1	Case studies on any topic related to the course
2	Assignments / Tutorials.
3	Springboard training workshops
4	3D models / charts related to the course

Micro project could be group based. A suggestive list is given here, similar micro projects could be added by concerned faculty. Each student will maintain dated work diary with details of individual contribution. Assessment is done by project guide based on their performance and presentation of submission.

REFERENCES

Sr. No.	Author	Title	Publisher & Address
1.	Paul Bishop	Pollution prevention: Fundamentals and practices	McGraw Hill International
2.	Prasad Modak, C Visvanathan and Mandar Parasnis	Cleaner Production Audit (1995)	Environmental system review, Asian institute of technology, Bangkok.
3.	Bewik M W M	Handbook of organic waste conversion	Bewik M W M

LEARNING WEBSITES / WEB REFERENCES :

- [www.researchgate.net/publication/350443477_Green_Technology_and_its_Implications_World wide](http://www.researchgate.net/publication/350443477_Green_Technology_and_its_Implications_World_wide)
- www.jetir.org/papers/JETIREW06032.pdf
- www.wipo.int/edocs/pubdocs/en/wipo-pub-1080-en-green-technology-book.pdf
- https://www.niraripublication.com/ijaes17/ijaesv12n5_18.pdf
- <https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage>
- https://econtent.msbt.edu.in/econtent/econtent_home.php



ST. XAVIER'S TECHNICAL INSTITUTE

To Nurture the Joy of Excellence in the World of High Technology

CURRICULUM FOR INTELLECTUAL PROPERTY RIGHTS

Document Number: PBoS-2526-April-23509-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	INTELLECTUAL PROPERTY RIGHTS	AAP	VRR	SBG



EXECUTIVE SUMMARY

This course on **Intellectual Property Rights (IPR) (23509)** is designed to provide students with a fundamental understanding of legal frameworks, protection mechanisms, and strategic importance of intellectual property in engineering and interdisciplinary fields. The curriculum emphasizes awareness of ownership rights and innovation protection in the context of technological development.

The course begins with an **Introduction to IPR**, covering basic concepts, objectives, and the significance of intellectual property in innovation-driven industries. It further includes an **Overview of IP Types**, such as patents, copyrights, trademarks, and industrial designs, enabling students to distinguish between different forms of intellectual assets.

Students are then introduced to **Patents in Interdisciplinary Electronics Fields**, focusing on innovation protection in electronics, embedded systems, and emerging technologies. The curriculum also covers **IP Filing and Laws**, providing knowledge of patent filing procedures, legal requirements, and regulatory frameworks governing intellectual property protection.

Additionally, the course includes **IP Tools and Resources**, enabling students to explore databases, search tools, and platforms used for patent analysis and documentation. The study of **IPR Case Studies** helps learners understand real-world applications, legal disputes, and successful innovation protection strategies.

Overall, the course equips students with essential knowledge of intellectual property systems, legal awareness, and innovation management skills required for protecting and leveraging technical inventions in professional practice.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Mr. Abhijit Patil	Subject Expert	
2	Dr. Vijay Rathod	Subject Expert	

Program Title			Diploma in Electronics & Telecommunication Engineering														
Course Code			Course Title			INTELLECTUAL PROPERTY RIGHTS (IPR)								Course Type		Semester	
23509														GE		5	
Learning Scheme						Assessment Scheme											
Actual Contact Hrs./Week			SLH	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total	
CL	TL	LL				FA	SA	Total		FA		SA					
								Max	Min	Max	Min	Max	Min	Max	Min		
2	---	2	2	6	3	---	---	---	---	50	20	---	---	50	20	100	
	1) Theory paper duration 3 hrs. 2) Theory paper assessment is Internal and External. 3) The assessment of Practical is Internal and External. 4) Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5) The assessment of Self Learning (SLA) is Internal.																

RATIONALE:

In the age of innovation and knowledge economy, intellectual property (IP) plays a crucial role in protecting creators' rights and promoting technological development. This course introduces students to the fundamental concepts of IPR such as patents, copyrights, trademarks, and industrial designs, with special emphasis on electronics and communication innovations. Understanding IPR equips students with the knowledge to safeguard their technical work, promotes ethical innovation, and prepares them to navigate legal aspects of their profession.

COURSE OUTCOMES:--

Semester	5	Subject	INTELLECTUAL PROPERTY RIGHTS
CO 509		9th Course in Third Year	
CO 509.1		Understand the need and evolution of intellectual property rights in engineering and business.	
CO 509.2		Explain different types of intellectual properties and their relevance to electronics/communication engineering.	
CO 509.3		Interpret patent documents and identify components of patent specifications.	
CO 509.4		Describe the procedures for filing different forms of intellectual property in India.	
CO 509.5		Use online tools to perform IP searches, classifications, and analyze case studies.	
CO 509.6		Apply IPR knowledge to protect innovative electronic solutions or ideas developed individually or in teams.	

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	INTELLECTUAL PROPERTY RIGHTS								
	9 th course in Third Year								
CO 509	P01	P02	P03	P04	P05	P06	P07	PS01	PS02
CO 509.1	3	2	-	-	2	1	2	2	-
CO 509.2	3	3	-	-	3	2	2	2	-
CO 509.3	3	3	2	2	2	2	2	3	1
CO 509.4	2	3	2	1	3	2	2	2	1
CO 509.5	2	2	3	2	3	3	3	3	2
CO 509.6	2	3	3	3	3	3	3	3	2
CO TOTAL	15	15	10	08	16	13	14	15	06
CORRELATION LEVEL	3	3	2	2	3	2	2	3	1

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0, 1, 2	3, 4, 5, 6, 7, 8	9, 10, 11, 12, 13, 14	15, 16, 17, 18
CORRELATION LEVEL	0	1	2	3

	Section -- 1						
Chapter No	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	INTRODUCTION TO IPR						
1.1	Definition, scope, importance of IPR in R&D, technology transfer, innovation and entrepreneurship.	04	---	---	---	---	CO 509.1
1.2	IPR and the knowledge economy.						
2	OVERVIEW OF IP TYPES						
2.1	Patents, copyrights, trademarks, industrial designs, geographical indications, trade secrets.	06	---	---	---	---	CO 509.2
2.2	Features, protection mechanisms, and examples.						
3	PATENTS IN INTER-DISCIPLINARY ELECTRONICS FIELDS						
3.1	Patentable vs non-patentable inventions prior art.	06	---	---	---	---	CO 509.3
3.2	Novelty.						
3.3	Inventive step.						
3.4	Claims and specifications.						
3.5	Patent examples in ECE domain.						

	Section – 2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
4	IP FILING & LAWS						
4.1	Indian IP laws, filing process (patent/copyright/trademark),	06	---	---	---	---	CO 509.4
4.2	Forms, timelines, fees, infringement and remedies.						
5	IP TOOLS & RESOURCES						
5.1	Indian patent database (InPASS),	04	---	---	---	---	CO 509.5
5.2	WIPO, USPTO, trademark search, classification systems (NICE, LOCARNO),						
5.3	Patent analytics.						
6	IPR CASE STUDIES						
6.1	Case studies of IPR.	06	---	---	---	---	CO 509.6
6.2	Ethical practices, student startup/IP protection strategies.						

IMPLEMENTATION STRATEGY:

- **Classroom Teaching:** Use of case studies, multimedia, real patents.
- **Practical Training:** Hands-on sessions using InPASS, WIPO, and trademark search tools.
- **Assignments:** Drafting of simulated IPR forms, reviewing case laws.
- **Group Activities:** Role-play, debates on infringement ethics, innovation challenges.
- **Microproject Integration:** Encouraging IPR-centric project ideation and protection strategy.

LIST OF LABORATORY EXPERIENCES

EXP. NO.	TITLE	COURSE OUTCOME	CHAPT. NO.
1	Conduct a trademark search for any existing electronics brand and classify it. (Part 1)	CO 509.2	2
2	Conduct a trademark search for any existing electronics brand and classify it. (Part 2)	CO 509.2	2
3	Use Software Tool to design a Tread Mark (Part 1)	CO 509.3	3
4	Use Software Tool to design a Tread Mark (Part 2)	CO 509.3	3
5	Perform a patent search using the InPASS database (Part 1)	CO 509.5	5
6	Perform a patent search using the InPASS database (Part 2)	CO 509.5	5
7	Use Software Tool for Patent Diagram (Part 1)	CO 509.4	4
8	Use Software Tool for Patent Diagram (Part 2)	CO 509.4	4
9	Draft a simulated provisional patent specification (Part 1)	CO 509.6	6
10	Draft a simulated provisional patent specification (Part 2)	CO 509.6	6

IMPLEMENTATION STRATEGY

1. Teaching plan
2. Minimum 8 practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, .and so on.....)

LAB EXPERIENCE		1	2	3	4	5	6
	COURSE OUTCOMES	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)
STUDENT SPNO							
2303001							
2303002							
2303003							

*The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.

SUGGESTED LIST OF MICROPROJECTS FOR SELF LEARNING

SR. NO.	TITLE
1	Design and draft a provisional patent specification for a student-developed electronic sensor system.
2	Prepare a trademark registration portfolio for a fictional tech startup (logo, class, description).
3	Analyze 3 patent documents related to wireless communication and prepare a comparison chart.
4	Study the IPR policy of a reputed university or startup and summarize it.
5	Create an awareness brochure explaining IPR filing steps for diploma students
6	Design and draft a provisional patent specification for a student-developed electronic sensor system.
7	Prepare a trademark registration portfolio for a fictional tech startup (logo, class, description).

Micro project could be group based. A suggestive list is given here, similar micro projects could be added by concerned faculty. Each student will maintain dated work diary with details of individual contribution. Assessment is done by project guide based on their performance and presentation of submission.

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	Intellectual Property India	The Patents Act, 1970	-		Intellectual Property India
2.	Bare Act	Intellectual Property Laws	-	2024	Bare Act
3.	Dr. Jyoti Rattan	Trademarks Law	-	2021	Bharats
4.	David Pressman	Patent It Yourself	21 st	2022	Nolo

LEARNING WEBSITES / WEB REFERENCES :

- <https://ipindia.gov.in/>
- <https://ict-ipr.in/>
- <https://www.iprsonline.org/>
- <https://www.wipo.int/portal/en/index.html>
- <https://www.youtube.com/watch?v=54RfREtjX1w&list=PLzf4HHlsQFwJXYT5k0rYh1HRLZ4gJa 2dG>
- https://econtent.msbte.edu.in/econtent/econtent_home.php



ST. XAVIER'S TECHNICAL INSTITUTE

To Nurture the Joy of Excellence in the World of High Technology

CURRICULUM FOR PROJECT MANAGEMENT

Document Number: PBoS-2526-April-23510-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	PROJECT MANAGEMENT	MMM	VRR	SBG



EXECUTIVE SUMMARY

This course on **Project Management (23510)** is designed to provide students with essential knowledge and skills required for planning, executing, and controlling engineering and technology projects effectively. The curriculum focuses on developing structured thinking, managerial competence, and decision-making abilities aligned with professional project environments.

The course begins with **Fundamentals of Project Management**, introducing key concepts, project life cycle phases, and management principles used to achieve project objectives within defined constraints. It further covers **Initiating Projects**, enabling students to understand project identification, feasibility analysis, stakeholder identification, and goal definition.

Students are then introduced to **Project Planning and Scheduling**, focusing on work breakdown structures, resource allocation, time management, and scheduling techniques for efficient project execution. The curriculum also emphasizes **Assessing and Managing Risk**, helping learners identify potential risks, evaluate their impact, and apply mitigation strategies.

The course further includes **Executing and Monitoring Projects**, where students learn about progress tracking, performance measurement, and corrective actions to ensure successful project delivery. It also addresses **Project Leadership and Ethics**, highlighting leadership roles, team coordination, ethical practices, and professional responsibility in project environments.

Overall, the course equips students with comprehensive project management capabilities, enabling them to plan, organize, and execute projects efficiently while ensuring quality, accountability, and ethical decision-making in professional practice.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Dr. Mahesh Munde	Subject Expert	
2	Mr. Sanjiv Borkar	Subject Expert	

Program Title			Diploma in Electronics & Telecommunication Engineering																
Course Code			Course Title			PROJECT MANAGEMENT										Course Type		Semester	
23510																GE		5	
Learning Scheme						Assessment Scheme													
Actual Contact Hrs./Week			THS	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total			
CL	TL	LL				FA	SA	Total		FA		SA							
								Max	Min	Max	Min	Max	Min	Max	Min				
2	---	2	2	6	3	---	---	---	---	50	20	---	---	50	20	100			
1) Theory paper duration 3 hrs. 2) Theory paper assessment is Internal and External. 3) The assessment of Practical is Internal and External. 4) Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5) The assessment of Self Learning (SLA) is Internal.																			

RATIONALE:

The Project Management course is designed to equip Electronics and Telecommunication (EXTC) diploma students with essential skills to effectively plan, execute, monitor, and close engineering projects. In today's fast-evolving technical and industrial landscape, professionals are expected not only to possess technical knowledge but also to manage time, cost, resources, and risks efficiently. This course addresses that gap.

COURSE OUTCOMES: --

Semester	5	Subject	PROJECT MANAGEMENT
CO 510	10th Course in Third Year		
CO 510.1	Apply selection criteria to choose appropriate projects		
CO 510.2	Develop a Work Breakdown Structure (WBS) and create project schedules		
CO 510.3	Identify and manage project risks effectively		
CO 510.4	Demonstrate an understanding of leadership principles and ethical responsibilities.		

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	PROJECT MANAGEMENT								
	10th Course in Third Year								
CO 510	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2
CO 510.1	2	2	1	-	-	3	2	1	0
CO 510.2	3	3	2	2	1	3	2	2	2
CO 510.3	1	3	3	2	1	3	3	2	2
CO 510.4	-	1	2	-	3	3	2	1	0
CO TOTAL	6	9	8	4	5	12	9	6	4
CORRELATION LEVEL	1	2	2	1	1	3	2	1	1

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0, 1, 2	3, 4, 5, 6,	7, 8, 9	10, 11, 12
CORRELATION LEVEL	0	1	2	3

	Section -- 1						
Chapter No	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	FUNDAMENTALS OF PROJECT MANAGEMENT						
1.1	Definition of a project and necessity of project management.	04	---	---	---	---	CO 510.1
1.2	Triple constraints (Time, Cost, Scope).						
1.3	Project life cycle.						
1.4	Project phases and Role of the project manager.						
2	INITIATING PROJECTS						
2.1	Project initiation process.	06	---	---	---	---	CO 510.1
2.2	Project selection models and proposal development.						
2.3	Effective project team formation and team dynamics.						
2.4	Stages of team development.						
3	PROJECT PLANNING AND SCHEDULING						
3.1	Work Breakdown Structure (WBS) and Linear Responsibility chart.	06	---	---	---	---	CO 510.2
3.2	Interface coordination and concurrent engineering.						
3.3	Project cost estimation and budgeting (Top-down and Bottom-up).						
3.4	Introduction to PERT, CPM, and Gantt charts.						

	Section -- 2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
4	ASSESSING AND MANAGING RISK						
4.1	Crashing project time and Resource loading.	06	---	---	---	---	CO 510.3
4.2	Project stakeholders and communication.						
4.3	Risk management planning.						
4.4	Qualitative and quantitative risk assessment.						
4.5	Risk response strategies.						
5	EXECUTING AND MONITORING PROJECTS						
5.1	Planning, monitoring, and controlling cycle.	06	---	---	---	---	CO 510.3
5.2	Information needs and reporting.						
5.3	Engaging with project stakeholders.						
5.4	Project meetings and documentation.						
5.5	Using milestones for measurement.						
6	PROJECT LEADERSHIP AND ETHICS						
6.1	Introduction to project leadership	04	---	---	---	---	CO 510.4
6.2	Ethics in project management.						

IMPLEMENTATION STRATEGY:

- Use of PowerPoint presentations and Videos
- References from the internet **(for teachers as well as students)**
- Extensive use of examples and case studies.
- Group discussions and micro project
-

LIST OF LABORATORY EXPERIENCES

EXP. NO.	TITLE	COURSE OUTCOME	CHAPT. NO.
1.	Time Vs Cost Analysis	CO 510.1	1
2.	Project Proposal Preparation	CO 510.1	2
3.	Team Role Play – Project Stakeholders	CO 510.1	2
4.	Work Breakdown Structure (WBS) Creation	CO 510.2	3
5.	Gantt Chart Development	CO 510.2	3
6.	Project cost estimation	CO 510.2	4
7.	Risk Assessment Matrix	CO 510.3	4
8.	Project Closure Report	CO 510.3	5
9.	Listing Ethics	CO 510.4	6
10.	Roles of Leaders	CO 510.4	6

IMPLEMENTATION STRATEGY

1. Teaching plan
2. Minimum 8 practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, .and so on.....)

LAB EXPERIENCE		1	2	3	4	5	6
	COURSE OUTCOMES	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)
STUDENT SPNO							
2303001							
2303002							
2303003							

***The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.**

SUGGESTED LIST OF MICROPROJECTS FOR SELF LEARNING

SR. NO.	TITLE
1.	Creating a Gantt chart for a residential construction project
2.	Work Breakdown Structure (WBS) for organizing an event
3.	Critical Path Method (CPM) analysis for a software rollout
4.	Risk assessment plan for a startup launch
5.	SWOT analysis and risk mitigation strategy for an e-commerce business
6.	Building a risk register for a college fest
7.	Budget estimation and cost tracking for a small-scale IT project
8.	Resource allocation and optimization for a manufacturing unit
9.	Manpower planning for organizing a conference
10.	Time management plan for academic group projects

Micro project could be group based. A suggestive list is given here, similar micro projects could be added by concerned faculty. Each student will maintain dated work diary with details of individual contribution. Assessment is done by project guide based on their performance and presentation of submission.

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	Erik Larson & Clifford Gray	Project Management: The Managerial Process	8th	2021	McGraw-Hill Education
2.	M.R. Gopalan	Project Management Core Textbook	2nd	-	Wiley India
3.	Rupal Jain	Mastering Project Management: PMP and Agile for Leaders	-	2024	Shroff Publishers & Distributors Pvt. Ltd.
4	S. Choudhary	Project Management	-	2013	McGraw-Hill India

LEARNING WEBSITES / WEB REFERENCES:

- URL: <https://www.pmi.org>
- URL: <https://www.projectmanager.com/blog>
- URL: <https://www.wrike.com/project-management-guide>
- URL: <https://www.smartsheet.com/learning-center>
- URL: https://www.mindtools.com/pages/main/newMN_PPM.htm
- <https://www.coursera.org>
- <https://www.edx.org>
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CURRICULUM FOR DIGITAL MARKETING

Document Number: PBoS-2526-April-23511-00

REV. NO.	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00	13 April 2025	DIGITAL MARKETING	VN	VRR	SBG



EXECUTIVE SUMMARY

This course on **Digital Marketing (23511)** is designed to provide students with foundational knowledge and practical skills required to plan, implement, and manage digital marketing strategies in modern business environments. The curriculum focuses on developing competencies in online brand promotion, audience engagement, and data-driven marketing techniques.

The course begins with an **Introduction to Digital Marketing**, covering core concepts, digital channels, and the evolution of online marketing ecosystems. It further includes **Website Planning and Development**, enabling students to understand website structure, user experience design, and content organization for effective digital presence.

Students are then introduced to **Search Engine Optimization (SEO)**, focusing on improving website visibility and organic search rankings through on-page and off-page techniques. The curriculum also covers **Search Engine Marketing (SEM) and Google Ads**, emphasizing paid advertising strategies, keyword targeting, and campaign optimization.

Additionally, the course includes **Social Media Marketing (SMM)**, where learners explore strategies for brand building, content marketing, and audience engagement across major social platforms. The program concludes with a **Capstone Project and Presentations**, allowing students to apply digital marketing concepts in real-world scenarios and demonstrate their analytical and creative skills.

Overall, the course provides a strong foundation in digital marketing tools and strategies, equipping students with industry-relevant competencies for careers in online marketing, media, and digital business environments.

Curriculum Development Committee Members

Sr. No.	Faculty Members	Role of Faculty	Signatures
1	Mr. Vinay Naglikar	Subject Expert	
2	Mrs. Surbhi Gaoshinde	Subject Expert	

Program Title			Diploma in Electronics & Telecommunication Engineering																
Course Code			Course Title			DIGITAL MARKETING										Course Type		Semester	
23511																GE		5	
Learning Scheme						Assessment Scheme													
Actual Contact Hrs./Week			SLH	NLH	CREDITS	THEORY				PRACTICAL				SLA		Total			
CL	TL	LL				FA	SA	Total		FA		SA							
								Max	Min	Max	Min	Max	Min	Max	Min				
2	---	2	2	6	3	---	---	---	---	50	20	---	---	50	20	100			
1) Theory paper duration 3 hrs. 2) Theory paper assessment is Internal and External. 3) The assessment of Practical is Internal and External. 4) Formative Assessment (Theory)out of 30 marks is average of 2 periodical tests (PT). 5) The assessment of Self Learning (SLA) is Internal.																			

RATIONALE:

The digital marketing is currently gaining popularity due to its ease of use and impact on the society. The primary purpose of this course is to equip undergraduate students with the knowledge and practical skills needed to succeed in the rapidly evolving digital marketing landscape. With businesses increasingly shifting their marketing budgets from traditional to digital platforms, there is a growing demand for professionals who understand digital tools, platforms, and strategies. It balances foundational theory with practical skills, preparing students for real-world applications in the digital marketing field.

COURSE OUTCOMES: --

Semester	5	Subject	DIGITAL MARKETING
CO 511		11th Course in Third Year	
CO 511.1		Understand core concepts and strategies of digital marketing.	
CO 511.2		Create and manage SEO and PPC campaigns.	
CO 511.3		Develop and schedule social media content for various platforms	
CO 511.4		Build a basic business website and analyze web performance	
CO 511.5		Design an integrated digital marketing plan for a product or service.	

Mapping of Course outcomes (COs) to Program outcomes (POs)

SEM V	DIGITAL MARKETING								
	11 th course in Third Year								
CO 511	P01	P02	P03	P04	P05	P06	P07	PSO 1	PSO 2
CO 511.1	2	2	2	1	2	1	1	0	0
CO 511.2	2	2	1	1	1	1	1	0	2
CO 511.3	1	1	3	2	1	2	-	0	2
CO 511.4	1	1	2	3	1	2	-	0	2
CO 511.5	2	2	3	1	1	2	2	0	3
CO TOTAL	8	8	11	8	6	8	4	0	9
CORRELATION LEVEL	1	1	2	1	1	1	1	0	2

TABLE TO DECIDE CORRELATION LEVELS

CO SUM TOTAL	0, 1, 2	3, 4, 5, 6, 7, 8	9, 10, 11, 12, 13, 14	15, 16, 17, 18
CORRELATION LEVEL	0	1	2	3

	Section -- 1						
Chapter No	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
1	INTRODUCTION TO DIGITAL MARKETING						
1.1	Definition and Scope of Digital Marketing.	06	---	---	---	---	CO 511.1
1.2	Traditional vs. Digital Marketing.						
1.3	Evolution of the Digital Landscape.						
1.4	Key Digital Marketing Channels.						
1.5	Understanding the Digital Consumer.						
2	WEBSITE PLANNING & DEVELOPMENT						
2.1	Introduction to Website Structure.	04	---	---	---	---	CO 511.2
2.2	Basics of UX/UI Design.						
2.3	Hosting & Domain Names.						
2.4	Introduction to WordPress/Wix.						
2.5	Practical: Create a Personal or Business Website.						
3	SEARCH ENGINE OPTIMIZATION (SEO)						
3.1	How Search Engines Work.	06	---	---	---	---	CO 511.3
3.2	On-Page and Off-Page SEO.						
3.3	Keyword Research Tools (Google Keyword Planner, Uber suggest).						
3.4	Link Building Strategies.						
3.5	SEO Tools: Google Search Console, SEMrush.						

	Section -- 2						
Chapter No.	Topics	Periods	Marks				COs
		Hrs.	R	U	A	Total	
4	SEARCH ENGINE MARKETING (SEM) & GOOGLE ADS						
4.1	Google Ads Overview.	05	---	---	---	---	CO 511.4
4.2	Types of Google Ads (Search, Display, Shopping, Video).						
4.3	PPC Bidding Strategy.						
4.4	Ad Copywriting & Landing Page Design.						
4.5	Google Ads Campaign Setup (Hands-on).						
5	SOCIAL MEDIA MARKETING (SMM)						
5.1	Social Media Platforms Overview (Facebook, Instagram, LinkedIn, Twitter).	05	---	---	---	---	CO 511.3 CO 511.4
5.2	Content Strategy & Calendar						
5.3	Paid Social Media Advertising (Facebook/Instagram Ads)						
5.4	Influencer Marketing.						
5.5	Analytics & Optimization.						
6	CAPSTON PROJECT & PRESENTATIONS						
6.1	Develop and Present a Digital Marketing Campaign for a Real or Simulated Business.	06	---	---	---	---	CO 511.1 CO 511.3 CO 511.4
6.2	Include Strategy, Execution Plan, and Analytics.						
6.3	Final Presentation and Evaluation.						

IMPLEMENTATION STRATEGY:

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet **(for teachers as well as students)**
- 3) Extensive use of examples and case studies.
- 4) Group discussions and micro project

LIST OF LABORATORY EXPERIENCES

EXP. NO.	TITLE	COURSE OUTCOME	CHAPTER NO.
1.	Create a personal or business website using WordPress or Wix	CO 511.2	2
2.	Perform on-page SEO and keyword optimization using Google Keyword Planner	CO 511.4	4
3.	Launch a basic Google Ads search campaign Tools: Google Ads (Demo Account),	CO 511.4	4
4.	Create and schedule a week-long social media campaign on Meta Business Suite	CO 511.5	5
5.	Analyze website and campaign performance in Google Analytics,	CO 511.5	5
6.	Optimize a business for local search visibility using Google Business Profile	CO 511.5	5
7.	Plan and budget a micro-influencer campaign on Facebook	CO 511.5	5
8.	Design a product page optimized for conversion using Shopify	CO 511.5	5
9.	Build a digital marketing freelancer portfolio on LinkedIn	CO 511.5	5
10.	Project:- Apply all skills in a full campaign simulation	CO 511.6	6

Implementation Strategy

- Teaching plan
- Minimum 8 practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, .and so on.....)

LAB EXPERIENCE		1	2	3	4	5	6
	COURSE OUTCOMES	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)	C (out of 25)
STUDENT SPNO							
2303001							
2303002							
2303003							

***The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.**

SUGGESTED LIST OF MICROPROJECTS FOR SELF LEARNING

SR. NO.	TITLE
1.	Design homepage, about page, and blog section.
2.	Keyword research for a chosen topic.
3.	Optimize blog content and meta tags.
4.	Submit website to Google Search Console.
5.	Select keywords and set a bidding strategy.
6.	Design posts for Instagram and Facebook.
7.	Write and format a blog post using SEO best practices.
8.	Create a 30-second promotional video using templates.
9.	Set up domain and hosting (simulated or via free platforms).
10.	Create ad groups and write ad copy.

Micro project could be group based. A suggestive list is given here, similar micro projects could be added by concerned faculty. Each student will maintain dated work diary with details of individual contribution. Assessment is done by project guide based on their performance and presentation of submission.

REFERENCES

Sr. No.	Author	Title	Edition	Year of Publication	Publisher & Address
1.	Dave Chaffey & Fiona Ellis- Chadwick	Digital Marketing: Strategy, Implementation and Practice	8th	2022	Pearson
2.	Dr. Rajan Saxena	Contemporary Digital Marketing: A Global Perspective	4 th	2020	SAGE Publications
3.	Philip Kotler, Hermawan Kartajaya, Iwan Setiawan	Marketing 5.0: Technology for Humanity	2 nd	2023	Wiley.

LEARNING WEBSITES / WEB REFERENCES:

- Digital Marketing with AI Full Course for Beginners
- <https://youtu.be/kunkYTKFNtI?si=UibukBGrge21wv7c>
- Google Digital Garage – Fundamentals of Digital Marketing
- Link: academy.hubspot.com
- Link: Meta Blueprint
- Link: academy.semrush.com
- Link: Moz Blog | Moz Academy
- Link: neilpatel.com/blog | Ubersuggest
- Link: Coursera Digital Marketing Specialization
- Link: LinkedIn Learning
- Link: Think with Google
- https://econtent.msbte.edu.in/econtent/econtent_home.php