

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	Core-I	Subject Code:	MTPE 101	Subject Name		Electric Drives System			
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

UNIT-1 Review of Basic Electrical Drives: Need of variable speed drives, Review of speed control methods in DC and AC drives, role of electrical drives in energy conservation, classification of electrical drives, four -quadrant operation of electrical drives, stability of electrical drives.

UNIT-2 Basic Principles for Electrical Machine Analysis: Magnetically coupled circuits: review of basic concepts, magnetizing inductance, modelling linear and nonlinear magnetic circuits, Electromechanical energy conversion: principles of energy flow, concept of field energy and co-energy, Derivation of torque expression for various machines using the principles of energy flow and the principle of co-energy.

UNIT-3 Separately Excited DC Motor Drives: Review of the theory of DC machine, State -space model of a Separately Excited DC machine, reduced order model & transfer function of the DC machines, Review of controllers, Speed control of a separately excited DC drive with inner current loop and outer speed loop, Design of current and speed loops.

UNIT-4 Induction Motor drives: Review of speed control methods of induction motors, Implementation of scalar control with slip compensation scheme, Limitations of the scalar control method.

UNIT-5 Transient condition basic concept regarding transients in drives analysis of transient condition during starting braking reversal and sudden loading of dc drives energy involved in transient process analysis of transient behavior of the phase induction drive while starting and braking.

Learning Resources:

Text Books:

1. B.K. Bose, Modern Power Electronics & AC Drives, Pearson Education India, 2015, 1st Edition.
2. Rama Krishnan, Electric motor drives: modeling, analysis, and control, Pearson Education India, 2015, 1st Edition.
3. M.B. Patil, V. Ramanarayanan, V.T. Ranganathan, Simulation of Power Electronic Circuits, Narosa, 2013, 1st Edition.

Reference Books:

1. A. E. Fitzgerald, C Kingsley, Stephen D. Umans, Electric Machinery, TMH, 2017, 6th Edition.
2. Rik De Doncker, Duco W. J. Pulle, André Veltman, Advanced Electrical Drives: Analysis, Modeling, Control, Springer, 2011, 1st Edition.
3. Paul C. Krause, Oleg W, Scott D. Sudhoff, Analysis of Electric Machinery & Drive systems, IEEE Press, 2013, 3rd Edition.

Other Suggested Readings:

1. <https://nptel.ac.in/courses/108/106/108106023/>
2. <https://nptel.ac.in/courses/108/108/108108077/>

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	Core-II	Subject Code:	MTPE 102	Subject Name	Power Electronics Devices & Phase Controlled Circuits				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	Contact Hours			
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

UNIT - I

Power Semiconductor requirements, Structures, Static and dynamic characteristics of power semiconductor devices, Series and parallel operation of devices, Device drivers, Cooling of power devices, Device ratings, Protection against dv/dt and di/dt , Device data sheets, interpretations.

UNIT - II

Phase controlled rectifier configuration. Control of output voltage by sequence and sector control. Reduction on harmonics using multiple pulse control, design of rectifier circuit. Comparative aspects of design using convertor transformer forced sell turn off devices. Design of Chopper circuit, reduction of harmonic circuit, multiphase choppers. Analysis of rectifier and chopper circuit.

UNIT – III

Single phase and three phase controllers. Triggering techniques. Concept of dual converters. Circulating and non-circulating current.

UNIT – IV

Concepts of three phase to single phase and three phase to three-phase cycloconverter. Symmetrical and asymmetrical control. Harmonic analysis of output voltage.

UNIT – V

Different single -phase and three-phase line commutated converter configurations, performance analysis with different loads, Effect of source inductance, commutation and overlap, Inverter mode of operation, Gate circuit schemes for phase control.

BOOKS:

1. Power Electronics M.H. Rashid
2. Power Electronics Ned Mohan
3. Power Electronics P.C. Sen
4. Hand book of Power Electronics M.H. Rashid
5. Power Electronics M.D. Singh

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	PE-I	Subject Code:	MTPE 103(A)	Subject Name	Advanced Power Electronic Circuits				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	Contact Hours			
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

UNIT:1

Review of basic power electronics principles, Introduction to various power electronics supplies. Performance parameters for power electronics supplies and their measurement.

UNIT:2

DC to DC converters: two quadrant and full bridge non - isolated converters, Isolated converters, i.e., half - bridge, full bridge Zeta, and SEPIC topology, block diagram of converter control, modeling such as averaged model, linearized and state space model Design of DC inductor, Concept of integrated magnetic.

UNIT:3

AC Choppers: Modeling and analysis of AC choppers, harmonics control using symmetrical and asymmetrical waveform pattern, design and simulation.

UNIT:4

Static un -interruptible power supply, on -line, off -line and line interactive UPS, modes of operation, batteries and converters selection and design for UPS, performance evaluation of UPS, power factor correction techniques, control of UPS.

Reference Books:

1. Issa Batarseh, "Power Electronics Circuits", John Wiley & Sons Inc 2004.
2. Ned Mohan, "Power Electronics: Converters, Applications, and Design", John Wiley & Sons Inc 2003.
3. M. H. Rashid, "Power Electronics Circuits, Devices and Applications", third edition Pearson Education India, 2009.
4. L. Umanand, "Power Electronics Essential and Applications", Wiley India 2009.
5. K. Billing, "Switch Mode Power Supply Handbook", third edition McGraw Hill, Boston 2010.

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	PE-I	Subject Code:	MTPE 103(B)	Subject Name	Power Quality				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	Contact Hours			
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

UNIT I

Understanding Power quality, types of power quality disturbances, power quality indices, Causes and effects of power quality disturbances.

UNIT II

Causes and effects of harmonics, converter configuration and their contribution to supply harmonics, other sources of harmonics.

UNIT III

Radio interference, supply standards, elimination/suppression of harmonics, classical solutions & their drawbacks, passive input filters design of harmonic filters, Improved power quality converter topologies, (single and three phase), transformer connections, Elimination/suppression of harmonics using active power filters - topologies, and their control methods, PWM converter as a voltage source active filter, current source active filter,

UNIT IV

Active waveshaping of input line current, constant frequency control, constant tolerance band control, variable tolerance band control, discontinuous current control, Electromagnetic interference (EMI), EMI generation ,EMI standards, and elimination.

Reference Books:

1. Power Quality - by R.C. Duggan
2. Power system harmonics - by A.J. Arrillaga
3. Power electronic converter harmonics - by Derek A. Paice
4. Power Electronics -Mohan,Undeland,Robbins

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	PE-I	Subject Code:	MTPE 103(C)	Subject Name	Advanced Control System				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	Contact Hours			
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

UNIT-I

Review of Modeling and Analysis of LTI Systems: Modeling of physical Systems. Design specifications and performance indices, Motion control systems, State space method of description and its solution, Discretization of continuous-time state space model, Laplace and z-domain analyses of control systems, Controllability, Observability & Stability, Bode & Nyquist analysis, Root Loci.

UNIT-II

Continuous control design. Proportional, derivative and integral control action. PID controller tuning rules. Ziegler-Nichols method. Two degree of freedom control systems. Compensator design using Bode diagram in frequency response approach. Lag, Lead, Lag-lead compensator.

UNIT-III

Variable Structure Control and its applications. Examples on variable structure control.

UNIT-IV

Control of nonlinear dynamics: Lyapunov based control function, Phase plane technique, Lyapunov Stability analysis.

UNIT-V

Optimal Control: Calculus of variation, Euler-Lagrange equations, Boundary conditions, Transversality condition, Bolza problem, Pontryagin's maximum principle.

Reference:

1. Automatic Control System – B.C. Kuo, Prentice-Hall, New York, 1975.
2. Modern Control Engineering: K. Ogata, Prentice-Hall of India Ltd. New Delhi, 1992.
3. Digital Control Systems – B. C. Kuo, Oxford Pub.
4. Discrete-Time Control Systems – K. Ogata. Prentice-Hall of India Ltd. New Delhi

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	PE-II	Subject Code:	MTPE 104(A)	Subject Name	Static VAR Controllers and Harmonic Filtering				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	Contact Hours			
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	3	0	0	3

UNIT-1

Need for compensation – introduction to shunt and series compensation – objectives of shunt and series compensation – configuration and operating characteristics – Thyristor Controlled Reactor (TCR) – Thyristor Switched Capacitor (TSC) – Fixed Capacitor - Thyristor Controlled Reactor (FC – TCR) – Comparison of T CR, TSC and FC – TCR

UNIT-2

Commutation in DC motors, difference between mechanical and electronic Commutators, Hall sensors, Optical sensors, Multiphase Brushless motor, Square – Wave permanent magnet brushless motor drives, torque and EMF equation, torque – speed characteristics of Permanent Magnet Brushless DC Motors – controllers PM DC Motor

UNIT-3

Objectives of voltage and phase angle regulators – approaches to Thyristor – Controlled Voltage and Phase Angle Regulator

UNIT-4

POWER QUALITY: Power Quality problems in distribution systems, harmonics, harmonics creating loads, modeling, harmonic propagation, Series and parallel resonance s, harmonic power flow, Mitigation of harmonics, filters, passive filters, Active filters, shunt, series hybrid filters, voltage sags & swells, voltage flicker. Mitigation of power quality problems using power electronic conditioners. IEEE standards.

Texts/References

1. Narain G. Hingorani and Laszlo Gyugyi, “Understanding FACTS – Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers, New Delhi, 2001.
2. R. Mohan Mathur and Rajiv K. Varma, “Thyristor Based FACTS Controller for Electrical Transmission Systems”, Wiley Interscience Publications, 2002
3. G.T. Heydt, Power Quality, Stars in a Circle Publications, Indiana, 1991.
4. T.J.E. Miller, Static Reactive Power Compensation, John Wiley & Sons, New York, 1982.

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	PE-II	Subject Code:	MTPE 104(B)	Subject Name	Electric and Hybrid Vehicles				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	Contact Hours			
ES	MS	Assignment/Quiz	ES	LW		100	L	T	P
70	20	10	-	-	3		0	0	3

Unit 1: Introduction to Electric Vehicles: Evolution of Electric Vehicles, EV configurations - Fixed and variable gearing, Single and multiple motor drives, In-wheel drives, Parameters of EV systems - Weight and size parameters, Force parameters, Energy parameters, Performance parameters

Unit 2: Hybrid EV systems HEV configurations: Series hybrid system, Parallel hybrid system, Series-parallel hybrid system, Complex hybrid system, Power flow control in Series hybrid system, Parallel hybrid system, Series parallel hybrid system, Complex hybrid system, Case Study

Unit 3: Electric Propulsion Systems: DC motor drives, Induction motor drives, Permanent-magnet motor drives, Switched reluctance motor drives and their role in EV and HEV systems. Performance study of electrical propulsion system with respect to application.

Unit 4: Energy Sources in EV and HEV systems: Electrochemical Batteries – Terminology, Specific Energy, Specific Power, Energy Efficiency in Lead Acid Batteries, Nicked based batteries, Lithium based batteries, Requirement of Ultra capacitors – Features, Principle of operation and Performance of UC, High Speed Flywheels – Operating Principles, Power capacity, Flywheel technologies, Hybrid Energy Storage Systems, Fuel Cell – Principle of Operation and Performance

Unit 5: EV Auxiliary Systems: Battery characteristics and chargers, Battery indication, Temperature control unit, Power Steering Unit, Auxiliary Power Supply, Navigation system. Case Study: Public and Domestic Charging Infrastructure for Electric Vehicles.

References:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001
2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
3. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2 nd edition, 2009.
4. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	PE-II	Subject Code:	MTPE 104(C)	Subject Name	Power Semiconductor Devices				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	Contact Hours			
ES	MS	Assignment/Quiz	ES	LW		100	L	T	P
70	20	10	-	-	3		0	0	3

UNIT-1

Introduction: Fabrication - Characteristics of Power Semiconductor devices, Conduction process in Semiconductors, PN Junctions, and Charge control description of PN junction operation, Avalanche Breakdown.

Diodes: Introduction, Basic structure and I-V Characteristics, Breakdown voltage considerations, On-State Losses, Switching Characteristics, Power Diode Types- General purpose Diodes, Fast recovery Diodes and Schottk-y diode, Static & Dynamic performance, junction structure, Reverse recovery Characteristics, Snubber Circuit, Series — parallel operation, Spice-Diode Model.

UNIT -2

BJT: Introduction, Vertical Power Transistor structures, I-V characteristics, Physics of BJT Operations, Switching Characteristics, Breakdown voltages, Second breakdown, On-State losses, Types, Safe Operation Area (S.O.A), Switching Time, Base Drives Snubber Circuits, Power Darlington's Protection Circuits.

UNIT -3

MOSFETS: Introduction, Basic Structure, I-V characteristics, Physics of device Operations, Switching Characteristics, Operating Limitations & Types Principle of Operation, characteristics, SOA, Gate Drive Circuits, Spice model.

UNIT -4

IGBT: Introduction, Basic Structures, I-V characteristics, Physics of device Operations, Latchup in IGBTs, Switching Characteristics, Devise limits & SOA and Gate Driver Circuits, Comparison with MOSFETS and Power BJT, Junction Structure, Terminal Capacitance, Gate Driver Circuits, On-Off time, IGBT Spice modeling and simulation of the devices and circuits.

UNIT -5

Emerging Devices – Introduction, Power Junction Field Effect Transistors, Field controlled Thyristors, JFET-Based devices versus other power devices, MOS-Controlled Thyristors, Power-Integrated Circuits, New Semiconductor materials for power devices.

Textbooks

1. Power Electronics, Daniel W Hart, McGraw Hill.
2. Power Electronics Converters, Applications, and Design, Ned Mohan et al, Wiley, 3 rd Edition, 2014.
3. Semiconductor Device Modeling with Spice, G. Massobrio, P. Antognetti, McGraw-Hill, 2nd Edition, 2010.
4. Power Semiconductor Devices, B. Jayant Baliga, Springer, 2008. 5. Power Electronics Principles and Applications, Joseph Vithayathil, McGraw-Hill, 2011

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category		Subject Code:	MTPE 105	Subject Name	RESEARCH METHODOLOGY AND IPR				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	Contact Hours			
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
70	20	10	-	-	100	2	0	0	2

UNIT 1: INTRODUCTION TO RESEARCH METHODS

Definition and Objective of Research, Various steps in Scientific Research, Types of Research, Criteria for Good Research, Defining Research Problem, Research Design, Case Study Collection of Primary and Secondary Data, Collection Methods: Observation, Interview, Questionnaires, Schedules,

UNIT 2: SAMPLING DESIGN AND HYPOTHESIS TESTING

steps in Sampling Design, Types of Sample Designs, Measurements and Scaling Techniques - Testing of hypotheses concerning means (one mean and difference between two means -one tailed and two tailed tests), concerning variance – one tailed Chi-square test.

UNIT 3: INTERPRETATION AND REPORT WRITING

Techniques of Interpretation, Precaution in Interpretation, Layout of Research Report, Types of Reports, Oral Presentation, Mechanics of Writing Research Report

UNIT 4: INTRODUCTION TO INTELLECTUAL PROPERTY

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights, Innovations and Inventions trade related intellectual property rights.

UNIT 5: TRADE MARKS, COPY RIGHTS AND PATENTS

Purpose and function of trade marks, acquisition of trade mark rights, trade mark registration processes, trademark claims –trademark Litigations- International trademark law

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Text/References Books:

1. C.R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques, New Age International Publishers.
2. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", Delmar Cengage Learning.
3. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", Tata McGraw Hill Education.
4. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi,.
5. Ranjith Kumar, Research Methodology – A step by step Guide for Begineers, Sage publisher.
6. D Llewelyn & T Aplin W Cornish, "Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights", Sweet and Maxwell, .
7. Ananth Padmanabhan, "Intellectual Property Rights-Infringement and Remedies", Lexis Nexis,
8. Ramakrishna B and Anil Kumar H.S, "Fundamentals of Intellectual Property Rights: For Students,Industrialist and Patent Lawyers", Notion Press.
9. M.Ashok Kumar and Mohd.Iqbal Ali : "Intellectual Property Rights" Serials Pub.

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	LAB-I	Subject Code:	MTPE 106	Subject Name	Power Electronics Lab				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
-	-	-	90	60	150	0	0	4	2

List of Experiments:

1. Implementation of driver circuits for power switching devices (SCR/MOSFET/IGBT)
2. Losses and thermal estimation of power converters
3. Switching characteristics and driver circuits for wide band gap devices
4. Performance analysis of Single-phase controlled AC-DC one-pulse converter
5. Performance analysis of Single-phase controlled AC-DC two-pulse converter (R, RL-Load)
6. Performance analysis of Three-phase controlled AC-DC six-pulse converter (R, RL-Load)
7. Performance analysis of AC-AC voltage regulator
8. Performance analysis of AC-AC cyclo-converter
9. Voltage control of Single-phase inverter- R, RL load
10. Implementation of Three-phase inverter- R load
11. Duty ratio-controlled DC-DC converters (Buck, Boost, Buck-Boost)
12. Implementation of Multi quadrant chopper
13. PWM control of DC-AC inverters
14. Harmonic mitigations of VSI
15. Power factor correction circuit

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	LAB-II	Subject Code:	MTPE 107	Subject Name	Renewable Energy Lab				
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks	Contact Hours			
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
-	-	-	90	60	150	0	0	4	2

List of Experiments:

1. Solar water heating
2. Solar cooking
3. Solar concentrator
4. PV module characterization
5. Inverter performance analysis
6. Wind energy convertor
7. Biomass for energy
8. Solar passive concepts and thermal comfort

TECHNOCRATS INSTITUTE OF TECHNOLOGY

(An Autonomous Institute Affiliated to RGPV Bhopal)

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

Semester/Year		I	Program		M.Tech: Power Electronics				
Subject Category	Audit-1	Subject Code:	MTPE 108	Subject Name		ENGLISH FOR RESEARCH PAPER WRITING			
Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
ES	MS	Assignment/Quiz	ES	LW		L	T	P	
-	-	-	-	-	-	2	0	0	0

UNIT-I: Planning and preparation, word order & breaking up long sentences, structuring sentences and paragraphs.

Unit II: Being concise, avoiding redundancy, ambiguity and vagueness, literature survey - highlighting your findings, hedging, paraphrasing and plagiarism.

Unit III: Sections of a paper – abstract, introduction, etc. review of the literature, writing - methods, results, discussion, conclusions and final check.

Unit IV: Writing – Title, Abstract and Introduction, Review of Literature and Methods.

Unit V: Useful phrases and punctuation, in-text citation and bibliography – MLA/APA styles.

References:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg, London, 2011.
2. Day R. How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
3. Goldbort R. Writing for Science, Yale University Press, 2006.
4. Highman N. Handbook of Writing for the Mathematical Sciences, SIAM. Highman’s book, 1998.