PEOPLE'S UNIVERSITY, BHOPAL

(Applicable for Admitted from Academic Session 2019-20 onwards)

Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTCM12101	Construction Management	3	1	-	(70)	(30)	Min: 40 (D Grade)	(Nil)	(Nil)	(Nil)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test - Max Marks: 15	Assignment/Quiz/Attendance - Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional - Max Marks: Nil	Assignment / Quiz - Max. Marks: Nil

Pre-Requisite	**Nil**
Course Outcome	1. Student should be able to know types of construction contract, lump sum, unit rate.
	2. Student should be able to know technical specifications, drawings, tender bond, labour , material payment.
	3. Student should be able to know manage tender.

Unit	Contents (Theory)	Marks Weightage
I	**Contract Management - I :** Types of construction contract, Lump sum, Unit rate, Cost plus-fee, Cost plus percentage-fee, Incentive contracts, Nature of contract, Contract documents and contracting procedures, Contract revisions, Negotiated contracts, Contract claims.	**14**
II	**Contract Management – II:** Technical specifications, Drawings, Tender bond, Labour and material payment bonds, Scrutiny of tenders, Acceptance, letter of indent, Important contract clauses, Terms of payment, Retention acceptance and final payment, Maintenance period, Time for completion, Extension of time, Variation in work and conditions, Claims and disputes, liquidated damages, Termination rights and responsibility of client, Architect, Engineer, Contractor, Professional liability. Disputes in contracts, Sub-contracts purchase orders as contracts, Insurance contract and claims, Arbitration, Accounts.	**14**
III	**Tender Management:** Advance techniques of estimating, Principles of analysis of rates and specification, Writing for different types of construction industries, Capital structure, Theories.	**14**
IV	**Legal Frame Work of Construction:** Constitutional provisions relating to business and industry, Master plans, Indian contract Act, Arbitration act.	**14**
V	**Labour Laws and Legislation:** Contract labour (RRA) ACT 1970, laws relating to wages, Bonus & industrial disputes.	**14**

Text Book/References Books/ Websites:

1. B. N. Dutta ;Estimating & Costing; UBS Publisher Distributor (P) Ltd.
2. Sanjay Mahajan.; Quantity Surveying & Costing ;Shatya Prakashan.
3. Neeraj Kumar Jha; Construction Project Management; Person.
4. M.P.P.W.D. Code.;Laws relating to building & Engg. contracts in India.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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(Applicable for Admitted from Academic Session 2019-20 onwards)

Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTCM12102	Bridge Engineering	3	1	-	(70)	(30)	Min: 40 (D Grade)	(Nil)	(Nil)	(Nil)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test - Max Marks: 15	Assignment/Quiz/Attendance - Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional - Max Marks: Nil	Assignment / Quiz - Max. Marks: Nil

Pre-Requisite	**Nil**
Course Outcome	1. Student should able to know earthwork and soling.
	2. Student should able to understand bituminous properties, requirements& specification .
	3. Student should able to understand cement concrete road construction.

Unit	Contents (Theory)	Marks Weightage
I	**Introduction:** Definition and components of a bridge, Classification of bridges, Choice of a bridge type. **Investigation for Bridges:** Need for investigation, Selection of bridge site, Determination of design discharge for river bridge, Linear waterway, Economical span, Vertical clearance, Scour depth, Afflux, Traffic projection.	**14**
II	**Standard Specifications for Road Bridges:** Indian road congress bridge code, Width of carriageway, Clearances, Loads to be considered, Dead load, I.R.C. standard live loads, Impact effect, Application of live load on decks, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects, and Seismic force.	**14**
III	**Reinforced Concrete Bridges:** General, Types of bridges, Balanced cantilever bridges, Continuous girder bridges, Rigid frame bridges, Portal frame and arch bridges, Detailed design of solid slab and T-beam bridges.	**14**
IV	**Sub-structure and Foundation:** Design of piers and abutments (Masonry & R.C.C.). Types of foundations, Shallow, Pile, and Well foundations including their construction details.	**14**
V	**Bearings & Appurtenances:** Different types of bearings, joints and handrails, Construction and Maintenance of bridges, Methods of construction of concrete bridges, Causes of bridge failures, Inspection and maintenance.	**14**

Text Book/References Books/ Websites:-

1. Johnson Victor;Essentials of Bridge Engineering; Oxford & Ibh Publishing Co Pvt Ltd
2. Khadilkar;A text book of bridge Construction; McGraw Hill Education.
3. S. P. Bindra ;Bridge Engg; Dhanpat Rai Publications.
4. Raina.; Concrete bridges Handbook; Shroff Publishers.
5. Concrete Bridge Design SP-23 (ACI Publication)

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTCM12103	Remote Sensing & GIS	3	1	-	(70)	(30)	Min: 40 (D Grade)	(Nil)	(Nil)	(Nil)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test - Max Marks: 15	Assignment/Quiz/Attendance - Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional - Max Marks: Nil	Assignment / Quiz - Max. Marks: Nil

Pre-Requisite	**Nil**
Course Outcome	1. Student should able to know introduction of remote sensing ,electro magnetic spectrum.
	2. Student should able to understand opto mechanical electro optical sensors.
	3. Student should able to understand concepts of Tessellations Attributes and Levels of Measurement .

Unit	Contents (Theory)	Marks Weightage
I	**Introduction To Remote Sensing:** Introduction of remote sensing ,Electromagnetic spectrum, Effects of atmosphere, Scattering, Absorption-atmospheric window, Energy interaction with surface features, Spectral reflectance of earth objects and land covers, Resolution concepts, Types, Satellites, Orbits and missions.	**14**
II	**Data Acquisition In Different Platforms:** Historical development, Opto mechanical electro optical sensors, Across track and along track scanners, Multi spectral scanners, Characteristics of different types of platforms, Medium and high resolution missions, Future missions, Data products and characteristics, Formats	**14**
III	**GIS Data Input And Data Models:** Concepts of point, line polygon / area, Elevation and surface, Concepts of tessellations attributes and levels of measurement, Data sources, Ground and remote sensing survey, Collateral data collection, Input map scanning and digitization, Registration and geo referencing, Concepts of RDBMS, Raster data model, Grid, Data encoding, Data compression, Vector data model, Topological properties, Arc node data structure, Raster vs. vector comparison, File formats for raster and vector, Data conversion between raster and vector.	**14**
IV	**GPS Satellite System:** Different segments, Space, Control and user segments, Satellite configuration, GPS signal structure, Orbit determination and representation, Anti spoofing and selective availability, Task of control segment, GPS receivers.	**14**
V	**GPS Data Processing & GPS Observations:** Code and carrier phase observation, linear combination and derived observables, Concept of parameter estimation, Downloading the data ,Data processing, oftware modules -solutions of cycle slips, ambiguities, RINEX format. Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -basic constellation of satellite geometry & accuracy measures - applications-long baseline processing- use of different softwares available in the market.	**14**

PEOPLE'S UNIVERSITY, BHOPAL

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Text Book/References Books/ Websites:-

1. Paul R.Wolf; Elements of Photogrammetry; McGraw-Hill Science, 2001.
2. Rueger, J.M.; Electronic Distance Measurement; Springer-Verlag, Berlin, 4th edition, 1996.
3. Laurila, S.H. ; Electronic Surveying in Practice; John Wiley and Sons Inc, 1993
4. Rueger, J.M.; Electronic Distance Measurement; Springer-Verlag, Berlin, 4th edition, 1996.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTCM1202	Prefabrication Design & its Construction Tech.	3	1	-	(70)	(30)	Min: 40 (D Grade)	(Nil)	(Nil)	(Nil)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test - Max Marks: 15	Assignment/Quiz/Attendance - Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional - Max Marks: Nil	Assignment / Quiz - Max. Marks: Nil

Pre-Requisite	**Nil**
Course Outcome	1. Student should able to know prefabricated construction, necessity, advantages, disadvantages.
	2. Student should able to know modular coordination, basic module, planning and design modules .
	3. Student should able to know understand foundation, columns, beams, roof and floor panels.

Unit	Contents (Theory)	Marks Weightage
I	**Prefabricated Construction:** Prefabricated construction, Necessity, Advantages, Disadvantages, Mass produced steel, Reinforced concrete and masonry systems, Industrialised buildings.	**14**
II	**Modular Construction :** Modular coordination, Basic module, Planning and design modules, Modular grid systems, National building code specification, Standardizations, Dimensioning of products, Preferred dimensions and sizes, Tolerances and deviations layout and processes.	**14**
III	**Prefabricates:** Classification, Foundation, Columns, Beams, Roof and floor panels, Wall panels, Clay units, Box prefabricates, Erection and assembly.	**14**
IV	**Design of prefabricated Elements:** Lift points, Beams, Slabs, Columns, Wall panels, Footings, Design of joints to transfer axial forces, Moments and shear forces.	**14**
V	**Construction Techniques:** Large panel construction, Lift slab system, Glover system, constrains' jack-block system, Constain V-Plate system, Bis on system, Silber-Kuhi system, Control of construction processes.	**14**

Text Book/References Books/ Websites:-

1. Ryan E Smith; Prefab Architecture ;John Wiley and Sons.
2. Modern Modilur by Jill Herbers; Harper Design Publication.
3. David Bergman ;Sustainable Design;Princeton Architectural Press.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTCM1203	Construction Equipment and Material Management	3	1	-	(70)	(30)	Min: 40 (D Grade)	(Nil)	(Nil)	(Nil)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test - Max Marks: 15	Assignment/Quiz/Attendance - Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional - Max Marks: Nil	Assignment / Quiz - Max. Marks: Nil

Pre-Requisite	**Nil**
Course Outcome	1. Student should be able to know planning and selection of construction equipment
	2 . Student should be able to know production estimates, sizing and matching .
	3. Student should be able to know economics of construction equipment.

Unit	Contents (Theory)	Marks Weightage
I	**Planning and Selection of Construction Equipment :** Advantage of mechanization of construction industry, Merits of labour intensive construction, Planning for construction equipments, Analytical studies, Equipment operation, Selection of construction machinery & equipments.	**14**
II	**Production Estimates, Sizing and Matching :** Cycle time capacity ratings and output of excavators, Power shovels, Drag lines, Scrapper, Bulldozers, Tractor shovels rippers, Motor graders etc., Sizing and matching, Capacity ratings and output of compactors, Aggregate processing plant concrete production plants.	**14**
III	**Economics of Construction Equipment :** Equipment working rates, Investment cost, Depreciation cost, Major repair cost, Cost of fuel and lubricants, Cost of labour, Servicing and field repairs, Overheads, Recommendations of statutory bodies.	**14**
IV	**System Approach :** Problems of equipment management, Application of CPM in equipment management, Application of the assignment model, Transportation model and waiting line models in equipment management.	**14**
V	**Material Management :** Materials planning and budgeting, Role and functions at different levels of management and budgeting variations, Stages of materials management, A.B.C. analysis, Advantages, Mechanics purpose cautions, limitations and tabular analysis, Purchasing parameters and inter relationships, Time source quantity, Price, Quality, Grading systems, Special purchasing systems, Obsolescence, Scrap disposal.	**14**

Text Book/References Books/ Websites:-

1. Sitaraman ;Construction Planning & Managemen; Galgotia Publication Pvt Ltd.
2. S C Sharma ;Construction Equipment & Management; Khanna Book Publisher.
3. Dr. Mahesh Verma; Construction Equipment & its planning & application; Metropolitan Book Corporation.
4. S V Deodhar; Construction Equipment & job planning; Khanna Publication.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTCM1204	Financial Management in Construction Industries	3	1	-	(70)	(30)	Min: 40 (D Grade)	(Nil)	(Nil)	(Nil)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test - Max Marks: 15	Assignment/Quiz/Attendance - Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional - Max Marks: Nil	Assignment / Quiz - Max. Marks: Nil

Pre-Requisite	**Nil**
Course Outcome	1. Student should able to know principle of personnel management qualities of a personnel manager.
	2. Student should able to know principles of industrial trade unionism .
	3. Student should able to understand waste management man power waste, energy waste

Unit	Contents (Theory)	Marks Weightage
I	**Personnel Management:** Principle of personnel management, Qualities of a personnel manager, Objective of personnel management, Personnel policed procedures and programmes, Man power resources, Performance standards, Work rules, Recruitment and selection process, Training of personnel's, Need for training, Management development programmes, Wage and salary management, Profit sharing features-Fringe benefits general scope, Different types of fringe benefits and awards.	**14**
II	**Labour Management:** Trade Unions - Principles of industrial trade unionism, Objectives and functions, Essentials of trade union, Objectives, Forms levels and growth of worker's participation in management, Principles and main features of collective bargaining, Different industrial regulations and labour laws and acts – Industrial health and safety, Provisions under factory act, Accident and safety at construction sites, Nature and causes of accident, Safety programmes and their principles.	**14**
III	**Waste Management:** Introduction to waste and waste management, The concept of productivity and its inter relationship with productivity, Systems concept of waste, Complementarity of waste and resource management, Identification of construction waste material waste, Man power waste, Energy waste, Space waste time waste, Equipment waste, Capital waste, Utilities and services waste, Data and information waste, Design of waste reduction in construction, Reduction, Collection, Recycling treatment and disposal of waste in construction systems, Modelling of resources and waste flow in construction systems waste management and cost reduction.	**14**
IV	**Financial Management:** Managerial economics & financial statement nature and scope of managerial economics, Economic theories, Demand analysis and fore casting, Elasticities of demand, Cost and production analysis, Pricing decisions, Policies and practices, Break even analysis, Time value of money, Economics, Comparisons using time value of money basic of comparisons, Decision making amongst alternatives, Cash flow, Discounted cash flow, Taxation and inflation, Sinking fund provisions, Risks and uncertainties, Project risk and firm risk, Finances & working capital, Capital budgeting & Performance budgeting, Project selection, Control and evaluation, Pre-project and post project evaluation.	**14**
V	**Capital Generation & Financial Accounting Banking:** Financial Institutes like IFCI, IBI, International financing etc. Book keeping process in construction, Journals, ledgers etc. for labour cost, Materials and purchases miscellaneous ledgers and accounting procedures, Types of financial statements in govt.	**14**

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Text Book/References Books/ Websites:-

1. I.M. Pandey; Financial Management; Vikash Publication House.
2. S. B. Jha & Subhash Chander; Construction Management System; Jain Brother.
3. V. K. Shrivastava; Construction Planning & Management; Galgotia Publication.

Suggested List of Laboratory Experiments :- (Expandable): Nil

PEOPLE'S UNIVERSITY, BHOPAL

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTCM1205	Appropriate Technology and Energy Conservation	3	1	-	(70)	(30)	Min: 40 (D Grade)	(Nil)	(Nil)	(Nil)

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test - Max Marks: 15	Assignment/Quiz/Attendance - Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional - Max Marks: Nil	Assignment / Quiz - Max. Marks: Nil

Pre-Requisite	**Nil**
Course Outcome	1. Student should able to know appropriate technology - concept and its role in the present circumstances.
	2. Student should able to understand rural housing & rural environmental technologies.
	3. Student should able to understand rural roads - planning of rural roads, socio-economic aspects.

Unit	Contents (Theory)	Marks Weightage
I	**Appropriate Technology:** Concept and its role in the present circumstances, Advantages and disadvantages of appropriate technology, Applications of appropriate technology.	**14**
II	**Rural Housing & Rural Environmental Technologies:** Planning, Use of locally available materials, Construction techniques, Concept and scope in rural areas planning of water supply schemes in rural areas, Development of preferred sources of water, Springs, wells, Infiltration wells infiltration gallaries, Collection of rain water, Specific problems and method's in rural water supply and treatment, Treatment and disposal of waste water, Community and sanitary latrines, Compact and simple waste water disposal systems, Biogas plants.	**14**
III	**Rural roads:** Planning of rural roads, Socio-economic aspects, Materials for rural roads, Design aspects, Drainage problems and maintenance of rural roads, WBM road, Construction process of rural road.	**14**
IV	**Energy Conservation:** Energy production, Distribution and utilization, A review of global situation, Energy trends, Renewable and non renewable sources, Research reviews, Building designs and energy factors affecting energy budget in buildings and settlements, Design of buildings for minimizing energy, Solar, Wind and tidal energies, A review and their adoptability.	**14**
V	Construction techniques and environmental control, Types of low energy materials, Specification, Properties and Advantages of low energy material.	**14**

Text Book/References Books/ Websites:-

1. www.icevirtuallibrary.com

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total	External	Internal	Total (100)
MTCM1206	Material Testing-II	-	-	2	(Nil)	(Nil)	(Nil)	(70)	(30)	Min:40 (D Grade)

Duration of Theory (Externals): Nil

Theory Internal- Max Marks: Nil	Best of Two Mid Semester Test - Max Marks: Nil	Assignment/Quiz/Attendance - Max. Marks: Nil
Practical Internal Max Marks: 30	Lab work & Sessional - Max Marks: 15	Assignment / Quiz - Max. Marks: 15

Pre-Requisite	**Nil**
Course Outcome	1. To understand the basic knowledge of Indian standard penetration value of bitumen.
	2. To be able to understand the use of Indian standard stripping value of road aggregate.
	3. To get to know about the use of determination of field density Stability value for bituminous mix.

Text Book/References Books/ Websites: Nil

Suggested List of Laboratory Experiments:-

1. Determination of Penetration value of Bitumen.
2. Determination of Viscosity of Bituminous Material.
3. Determination of Softening point of bituminous material.
4. Determination of Ductility of the bitumen.
5. Determination of Flash point and Fire point of bituminous material.
6. Determination of Bitumen content by centrifuge extractor.
7. Determination of Stripping value of road aggregate.
8. Determination of Marshall Stability value for bituminous mix.

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total	External	Internal	Total (100)
MTCM1207	Software Lab-II	-	-	2	(Nil)	(Nil)	(Nil)	(70)	(30)	Min:40 (D Grade)

Duration of Theory (Externals): Nil

Theory Internal- Max Marks: Nil	Best of Two Mid Semester Test - Max Marks: Nil	Assignment/Quiz/Attendance - Max. Marks: Nil
Practical Internal Max Marks: 30	Lab work & Sessional - Max Marks: 15	Assignment / Quiz - Max. Marks: 15

Pre-Requisite	**Nil**
Course Outcome	1. To be able to understand the concept of MX Roads.
	2. To understand the 3DS Max.
	3. To get to know about the Auto Plotter

Unit	Contents (Theory)	Marks Weightage
I	Primavera, MX Roads, Auto Plotter, 3DS Max, IREVIT	**100**

Text Book/References Books/ Websites: Nil

Suggested List of Laboratory Experiments :-

Student should prepare a report on a project (Highway or Building) using any of the software as per assigned by subject faculty.

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Programme: **Master of Technology** **Specialization:** Construction Technology & Management **Semester –II**

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (50)	External	Internal	Total
MT1208	Audit Course - II (English For Research Paper Writing)	-	-	-	(35)	(15)	Min: 20 (D Grade)	(Nil)	(Nil)	(Nil)

Duration of Theory (Externals): 2 Hours

Theory Internal- Max Marks: 15	Best of Two Mid Semester Test – Max Marks: Nil	Assignment/Quiz/Attendance Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: Nil	Assignment / Quiz Max. Marks: Nil

Pre-Requisite	**Nil**
Course Outcome	1. Student will understand that how to improve your writing skills and level of readability.
	2. Learn about what to write in each section of research article.
	3. Understand the skills needed when writing a Title.

Unit	Contents (Theory)	Marks Weightage
I	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing, Redundancy, Avoiding Ambiguity and Vagueness.	**07**
II	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.	**07**
III	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	**07**
IV	Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.	**07**
V	Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions, useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	**07**

Text Book/References Books/ Websites

1. R. Goldbort (2006) ;Writing for Science;Yale University Press (available on Google Books).
2. R. Day (2006); How to Write and Publish a Scientific Paper; Cambridge University Press.
3. N Highman ;(1998), Handbook of Writing for the Mathematical Sciences; SIAM. Highman's book.
4. Adrian Wallwork ; English for Writing Research Papers; Springer New York Dordrecht Heidelberg London, 2011
5.

Suggested List of Laboratory Experiments :- (Expandable): Nil