Jaypee Institute of Information Technology

M. TECH BIOTECHNOLOGY

Course Descriptions

SEMESTER 1

BIOMOLECULES AND CELL COMMUNICATION

Course Code	**17M11BT111**	**Semester** Odd	**Semester** VI Integrated/MTech I **Session** 2021-2022 **Month from** July-December
Course name	**Biomolecules and Cell Communication**		
Credits	3	**Contact hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Reema Gabrani
	Teacher(s) **(Alphabetically)**	Dr. Reema Gabrani

COURSE OUTCOMES		**COGNITIVE LEVELS**
C110.1	Explain the signal molecules and major cell signaling pathways	Understand Level (C2)
C110.2	Analyze cell signaling pathways in normal and diseased conditions	Analyze Level (C4)
C110.3	Interpret the mechanisms and regulation of cell cycle and cell death	Understand Level(C2)
C110.4	Analyze the therapeutic drug targets for cancer	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of lectures for the module**
1.	Signal molecules	Cytokines and Hormones, Growth factors, neurotransmitters, extracellular matrix components as signaling molecules; autocrine, paracrine, juxtracrine and endocrine signaling	3

2.	G-protein linked signaling pathways	G Protein-Coupled Receptors, Heterotrimeric G Proteins, second messengers, Effector enzymes, Mechanism of transduction, Switching Off and Desensitization of receptors, Visual transduction pathway	8
3.	Signaling mediated by enzyme-linked cell surface receptor	Photoreceptor development in Drosophila, Ras to MAP kinase, Phosphoinositide-3-kinase and signaling through insulin in receptor, JAK-STAT pathway, Signal Transduction via Integrins	8
4.	Nuclear receptor-based signaling	Classification and Structure of Nuclear Receptors, Signaling by steroid hormones, Retinoids, Vitamin D3, and the T3-Hormone, Mechanisms of Transcriptional Regulation by Nuclear Receptors	4
5.	Bacterial Chemotaxis	Two-component signaling pathway, histidine kinase associated receptor, Adaptation, Chemotaxis pathogenicity, symbiotic associations and biofilm	3
6.	Cell cycle Regulation and cell death	Cyclin-CDK variation, Checkpoint signaling, Ubiquitin Proteasome proteolytic system, Intrinsic and Extrinsic Apoptotic pathways	8
7.	Malfunction of Signaling Pathways and Tumorigenesis	Hallmarks of cancer, Developmental pathways, and cancer : Notchsignalingg from Drosophila to humans, Wnt signaling, Hedgehog pathway; Epigenetic changes in cancer, Signalling pathways as therapeutic targets, Analysis of ssignalingevents via case studies	8
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20

T2	20
End Semester Examination	35
TA	25(Presentation, Assignments) PBL:7marks
Total 100	

PBL: Students will be given project in groups on "Bench to bedside case study in cell signaling". The project will link the signaling molecule and its cascade to the associated disease and the development a of therapeutic molecule.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks Reference Books, Journals, Reports, Websites in the IEEE format)

1.	B. Gomperts, l. Kramer, P. Tatham "Signal transduction",2nd Ed. Academic Press, 2009
2.	V W Rodwell, D Bender, K M Botham, P J Kennelly, P A Weil, "Harper's Illustrated Biochemistry", 31st Ed. McGraw-Hill Lange 2018
3.	Alberts, Johnson, Lewis, Morgan, Raff, Roberts and Walter, "Molecular Biology of the Cell" Sixth Edition, Garland Science Publication,2014
4.	Refereed papers from scientific journals for case studies

MOLECULAR MODELING AND DRUG DESIGN

Course Code	17M11BT112	**Semester Odd (specify Odd/Even)**	**Semester** I **Session** 2021-2022 **Month from** June to Dec
Course Name	**Molecular Modeling and Drug design**		
Credits	3	**Contact Hours**	**LTP 3 0 0**

Faculty (Names)	**Coordinator(s)**	Dr Shazia Haider
	Teacher(s) (Alphabetically)	Dr Shazia Haider

COURSE OUTCOMES		**COGNITIVE LEVELS**
C112.1	Explain macromolecular structures, their Mathematical representation and visualization	**Understanding** (C2)
C112.2	Explain structural modeling, simulation and dynamics	**Understanding** (C2)
C112.3	Apply computational drug designing and simulation approaches for drug discovery	**Applying**(C3)
C112.4	Compare *in-silico* ligand-target interaction methods	**Analyzing** (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Molecular Modeling	Introduction to structure of DNA, protein and RNA. Structure representation and visualization, Coordinate Systems, Potential Energy Surfaces, Software and Hardware for molecular modeling, Tools such as Swiss pdb viewer, Pymol, VMD etc.	5

2.	Quantum Mechanics and Force Fields	Electron methods and molecular orbital calculations, General Features of Molecular mechanics force field, Bond Stretching. Angle Bending. Introduction to Non-bonded Interactions. Electrostatic Interactions. Van der Waals Mechanics. Force Field Models for the Simulation of Liquid Water.	5
3.	Energy Minimization and computer simulations	Minimization and Related Methods for exploring the Energy Surface. Non-Derivative method, Minimization methods. Computer Simulation Methods. Simple Thermodynamic Properties and Phase Space. Boundaries. Analyzing the Results of a Simulation and Estimating Errors.	5
4.	Molecular Dynamics and simulations	Molecular Dynamics Simulation Methods. Molecular Dynamics Using Simple Models. Metropolis Method. Monte Carlo methods, Web Based Resources, Databases and tools such as GROMACS, AMBER, & CHARMM.	6
5.	Structure Prediction	Principles of structure prediction, comparative modeling and protein folding, Comparative and *ab-inito* modeling, CASP, validations, Projects such as ROSETTA, protein folding at home.	6
6.	Drug designing	Introduction to drug discovery and drug development, Rational approach to drug design, Approaches to lead optimization such as conformation restriction, pharmacophore etc. Designing drugs against enzymes and receptors, Computer Aided Drug Design methods. ADMET, QSAR Tools and databases such as AUTODOCK, MOLEGRO, Drug Bank etc.	16
		Total number of Lectures	**43**

Evaluation Criteria

Components	**Maximum Marks**
T1	20

T2	20
End Semester Examination	35
TA	25 (Assignment-1, MCQ, Project, Presentation, PBL)
Total	**100**

PBL: Students will choose any protein linked to a particular disease. How is it commercially used as a therapeutic molecule or as a target to manage the disease and its associated complications

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Andrew R leach, V.J Gillet, "An introduction to Chemoinformatic" Springer model of publication, 2007
2.	Gasteiger Johann, "Chemoinformatic A text book" John Wiley, 2008
3.	Andrew R. Leach, "Molecular Modeling principles and applications" Pearson Education, Second edition, 2001

PHYTOTHERAPEUTICS AND PHARMACOLOGY

Subject Code	**17M12BT119**	**Semester: ODD**	**Semester:** X **Session:** 2021-2022 **Month from:** July - Dec
Subject Name	**PHYTOTHERAPEUTICS AND PHARMACOLOGY**		
Credits	**3**	**Contact Hours**	**3+1**

Faculty (Names)	**Coordinator(s)**	1. Professor. Vibha Rani
	Teacher(s) (Alphabetically)	1. Professor. Vibha Rani

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO130.1	Analyze the existing biotechnological techniques to develop plant-based therapeutics	**Analyzing (C4)**
CO130.2	Evaluate the classes, synthesis and structure functional relationship of Phyto molecules	**Evaluating (C5)**
CO130.3	Explain the therapeutic applications of phytochemicals	**Understanding (C2)**
CO130.4	Identify the current aspects of phytomedicines on toxicity and clinical trials	**Applying (C3)**
CO130.5	Case studies to analyze Ayurpharmaco-epidemiology	**Analyzing (C4)**
CO130.6	Use of bioinformatics tools and approaches to predict the molecular function of novel bioactive molecules	**Creating (C6)**

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1	**Introduction**	Concepts of Phototherapeutics, Trend and market analysis, Global herbal medicine market, Herbal Sector in India	3

2	**Medicinal Plants** **Metabolites**	Introduction to metabolites, Secondary metabolites, properties and beneficial aspects.	3
3	**Isolation technique** **extraction procedure**	Pharmacology Approaches in Phototherapeutics, Bioactive guided discovery process Isolation from medicinal plants. Isolation from aromatic plants. Recants advancements in extraction	4
4	**Characterization technique**	Qualitative and quantitative Analysis Gas Chromatography High Performance Liquid Chromatography: (HPLC) High Performance Thin Layer Chromatography: (HPTLC)	4
5	**Structure functional relationship**	Bioinformatics approach in predicting structure functional relationship Mechanism of Action Unidentified Therapeutic Intakes Factors that Affect Metabolism	4
6	**Therapeutic Application**	Free radicals and antioxidants Plants used in Metabolic disorder Plants used in respiratory system Plants used in COVID Pandemic Plants used with antimicrobial activity. Plants used with neurodegenerative disorders Plants used in cardiovascular system.	8
7	**Toxicity Issue and Clinical Trials**	Current aspects of phytomedicine on toxicity and clinical trials	6

8	**Case studies**	Success stories, research-based case studies related to phototherapeutics	8
9	**Potential risks associated and future aspects**	Discussion	2
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Test-1, Assignment-1&2, PBL, Case studies 1, 2& 3)
Total	**100**

Project based learning: Each student will opt a human health issues and diseases. To make subject application based, the students will analyze uncharacterized Indian medicinal herbs and will explore their therapeutic potential and also perform market research. Various phototherapeutics concepts will be discussed by students. Students would explain the critical disease targets and mechanism of actions of selected herbs by *in silico* methods. Understanding the concepts would enhances the student's knowledge and motivation for herbal drug discovery and its continuously growing market which will help their employability into various biotechnology and health sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Papers, Reports, Websites etc. in the IEEE format)

1.	Plant Bioactive and Drug Discovery: Principles, Practice, and Perspectives. Valdir Cechinel-Filho (Ed.). 2012 John Wiley & Sons, Inc.
2.	Phototherapeutics (Recent Progress in Medicinal Plants). S. K. Sharma, J. N. Govil, V. K. Sing. 2005. Studium Press.
3.	Phytotherapies: Efficacy, Safety, and Regulation. Iqbal Ramzan (Ed.) 2015 John Wiley & Sons, Inc.
4.	Recent research articles and reviews related to each module.

PRODUCT DEVELOPMENT IN BIOTECHNOLOGY

Course Code	**17M12BT118**	**Semester** **Odd**	**Semester. III**. **Session** 2021-2022 **Month from July** – Dec
Course Name	**Product Development in Biotechnology**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Neeraj Wadhwa
	Teacher(s) (Alphabetically)	Dr. Neeraj Wadhwa

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Outline various processes relevant for Bio business	**Understand Level (C2)**
CO2	Compare marketing techniques and related ethics	**Apply Level (C2)**
CO3	Select appropriate technology for the production of biological products	**Understand Level (C3)**
CO4	Explain financial, regulatory, health policy aspects for biobased industries	**Understand Level (C2)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Biotechnology Industries overview**	Biotech industries in India and abroad, Biotechnology as a function of science and business, Company structures versus other non-biotech companies, Functional units Company structure and functions Emerging technology and technical convergences issues	**5**
2.	**Business in the context of biotechnology** **Entrepreneurship-**	Science/development, the idea and its development, Plant tissue culture lab-equipment- glassware's chemical requirement-- construction, techniques in culturing and export abroad, Vermitechnology, Mushroom cultivation, single cell protein, Biofertilizer technology-production, Textile processing, leather treatment, leather industry set up Detergent industry, bakery, diary, Technology product development Other	**14**

		biotech product development, such as biofuels, bioengineered foods, etc.- commercialization of Bakery and dairy products relevant case studies	
3.	**Product development**	a. Production of commercially important primary metabolites like organic acids, amino acids and alcohol & Production processes for various classes of secondary metabolites: Antibiotics, Vitamins and Steroids. production of Industrial Enzymes, Biopesticides, Biofertilizers, Bio preservatives, Biopolymers, Pulp and Paper, SINGLE CELL PROTEIN & Mushroom culture, Bioremediation. Bioprocess strategies in Plant Cell organ culture and Animal Cell culture.	**12**
4.	**Bio business plans**	Concerns and opportunities, Environmental clearances requirement from government, Quality checks and validation certificates, Branding, Marketing and Packaging concerns Bank loan and finance strategy, Budget planning, Policy and regulatory concerns,	**6**
5.	**Bioremediation Bioethics and legal issues**	Business Development public perception in product development, Sustainability, Environmental concerns of product and their waste as well of genetically modified products and organism-	**5**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment)
Total	**100**

Project Based Learning (PBL): Students will be skilled, prepared and oriented towards understanding the insight of various bio-based business development ideas. They will be made aware of various planning and policy systems existing in the global market to start and run a business. Students will also be trained to develop entrepreneurial skills.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Satyanarayana, U. "Biotechnology" Books & Allied (P) Ltd., 2005.
2.	Kumar, H.D. "A Textbook on Biotechnology" 2nd Edition. Affiliated East West Press Pvt. Ltd., 1998.
3.	Balasubramanian, D. et al., "Concepts in Biotechnology" Universities Press Pvt. Ltd., 2004.
4.	Ratledge, Colin and Bjorn Kristiansen "Basic Biotechnology" 2nd Edition Cambridge University Press, 2001
5.	Faber K, Biotransformation's in Organic Chemistry, IV edition, Springer
6.	Dubey, R.C. "A Textbook of Biotechnology" S. Chand & Co. Ltd., 2006. Trevor Palmer, Enzymes II ed Horwood Publishing Ltd
7.	Cruger, Wulf and Anneliese Crueger, "Biotechnology: A Textbook of Industrial Microbiology", 2nd Edition, Panima Publishing, 2000
8.	Moo-Young, Murrey, "Comprehensive Biotechnology", 4 Vols. Pergamon Press, (An Imprint of Elsevier) 2004.
9.	Richard Oliver "The coming Biotech Age; the business of Biomaterials "Mc Graw Hill Publication, New York USA2000
10.	Karthikeyan, S and Arthur Ruf." Bio business" MJP Publication Chennai India 2009
11.	Cynthia Robins," The business of Biotechnology". UK Harper Collins 2001

BIOTECHNIQUES LAB-I

Course Code	**17M15BT111**	**Semester Odd (Specify Odd/Even)**	**Semester I** **Session** 2021-2022 **Month from** July- December
Course Name	**Biotechniques Lab-I**		
Credits	3	**Contact Hours**	6

Faculty (Names)	**Coordinator(s)**	Dr. Reema Gabrani
	Teacher(s) (Alphabetically)	Dr. Chakresh K. Jain, Dr. Indira P. Sarethy, Dr. Neeraj Wadhwa, Dr. Pammi Gauba, Dr. Priyadarshini, Dr. Reema Gabrani, Dr. Sujata Mohanty, Dr. Vibha Rani

COURSE OUTCOMES		**COGNITIVE LEVELS**
C111.1	Apply basic analytical techniques in biotechnology	Apply Level (C3)
C111.2	Develop skills in molecular biology techniques	Apply Level (C3)
C111.3	Examine and analyse gene expression	Analyze (Level C4)
C111.4	Make use of purification techniques for natural products	Apply Level (C3)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Analytical techniques	To explore drug-protein interactions	2
2.	Molecular biology techniques	Cloning strategy: Screening of recombinants: isolate recombinant plasmid DNA from bacterial cells; Restriction enzyme digestion, separate and visualize DNA bands by agarose gel electrophoresis	4
3.	Gene expression techniques	Designing primers for amplification of gene of interest by PCR, PCR amplification, analyze PCR products; Analysis of a recombinant protein by polyacrylamide gel electrophoresis	3
4.	Purification techniques	To obtain antimicrobial compound from bacterial culture; to purify the antimicrobial compound by column chromatography; use of bioactivity-guided fractionation to analyze and quantify the compound	3
		Total	**12**

Evaluation Criteria

Components **Maximum Marks**

Mid-Term Viva	20
Day-to-Day (Lab record, attendance, performance)	60
Final Viva	20
Total	**100**

Project Based Learning: The students learn column chromatography, molecular biology, and analytical techniques and analyze gene expression which is required for the Biotech industry.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication, etc. Textbooks, Reference Books, Journals, Reports, Websites, etc. in the IEEE format)	
1.	Introduction to Biotechnology, Laboratory Manual: http://www.austincc.edu/awheeler/Files/BIOL%201414%20Fall%202011/BIOL1414_Lab%20Manual_Fall%202011.pdf
2.	Frederick M. Ausubo, Roger Brent, Robert E. Kingston, David D. Moore, J.G. Seidman, John A. Smith, Kevin Struhl (eds.) Current Protocols in Molecular Biology. John Wiley & Sons Inc; ringbou edition (December 4, 2003)
3.	Molecular Biology web book- http://www.web-books.com/MoBio/
4.	S. V. S. Rana, Biotechniques Theory and Practice. Rastogi Publications 2008.
5.	Methods standardized in lab

REGULATORY AFFAIRS

Course Code	17M12BT116	**Semester Odd**	**Semester X** **Session** 2021-2022 **Month from July**19-Dec19		
Course Name	Regulatory Affairs				
Credits	3	**Contact Hours**	3		
Faculty (Names)	**Coordinator(s)**	Dr Shweta Dang			
	Teacher(s) (Alphabetically)	Dr Shweta Dang			

COURSE OUTCOMES		**COGNITIVE LEVELS**
C120.1	Explain regulatory markets and agencies; preclinical and clinical trials	Understanding (Level 2)
C120.2	Analyze the guidelines for approvals of new drugs/biologics	Analyzing (Level 4)
C120.3	Compare innovator and generic pharmaceutical industry with Patent and Non patent exclusivity	Evaluating (Level 5)
C120.4	Interpret ICH guidelines applicable to drugs and biotechnology based therapeutic products.	Understanding (Level 2)
C120.5	Assess regulatory approvals via related case studies	Evaluating (Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction To Regulatory agencies	CDSCO, India USFDA, USA EMEA, European Union TGA, Australia	**2**
2.	Introduction To Pharmacopoeias and Monographs	Indian Pharmacopoeia (IP) British Pharmacopoeia (BP) United Sates Pharmacopoeia (USP) International Pharmacopoeia (Int. Ph.) European Pharmacopoeia (Eur. Ph.)	**2**

3.	Safety and efficacy of drugs/biologics, preclinical studies, Clinical phases	Case studies of safety issues in history, Preclinical requirements, acute and chronic toxicity, dose determination, NOAEL, phases of clinical trials (I, II III)	**4**
4.	Approval pathways for Drugs/ biologic/ biopharmaceuticals in USFDA	FDA, CDER, CBER, IND, NDA, BLA, recalls, Phase IV, filing procedures	**7**
5.	Approval pathways for Drugs/ biologic/ biopharmaceuticals in Europe	EMEA, market authorization application. Centralized, Decentralized, National, Mutual recognition procedure. CTD, eCTD, Nees Submissions, ICH M4	**4**
6.	Approval pathways for Drugs/ biologic/ biopharmaceuticals in India and Japan	Central Drug Standard Control Organization, INDIA, Pharmaceutical and Medical Devices Agency of Japan	**3**
7.	Generics and Biosimilars	Hatch Wax man Act (Para I, II, III and IV filings), BPCI act USA, CDSCO guidelines, EMEA guidelines, Status of guidelines	**6**
8.	Non-Patent Exclusivities	Orphan Drug law, Market exclusivity, Pediatrics exclusivity, first to file exclusivity	**5**
9.	ICH Guidelines for Biologics and Good Clinical Practices	Overview of ICH guidelines, ICH QSEM, ICH Q5, Q6, ICH E6, ICH Q8,9,10	**5**
11.	Case	Relevant Case studies	**4**

	Studies			
		Total number of Lectures	**42**	**06**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Test, Assignment I and II) PBL (5 Marks)
Total	**100**

PBL: Students will be given a project to search orange book database of USFDA and prepare a patent and non-patent exclusivity status of drugs

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Sandy Weinberg, GUIDEBOOK FOR DRUG REGULATORY SUBMISSIONS, 2009 (first edition), John Wiley & Sons, Inc.
2.	The Common Technical Document (CTD), Internet: http://www.ich.org/
3.	Guideline for submitting supporting documentation in drug applications for the manufacture of drug substances, February 1987, Internet: http://www.fda.gov/cder/guidance/drugsub.pdf
4.	ICH Guideline: The Common Technical Document for the Registration of Pharmaceuticals for Human Use: Quality - M4Q; Quality Overall Summary of Module 2, Module 3: Quality, Internet: http://www.ich.org/MediaServer.jser?@_ID=556&@_MODE=GLB

Research Methodology & Intellectual

Property Rights

Course Code	**18M11G E11 1**	**Semester** Odd	**Semester** I **Session** 2021-2022
Course Name	**Research Methodology & Intellectual Property Rights**		
Credits	2	**Contact Hours**	2-0-0

Faculty (Names)	**Coordinator(s)**	Prof. B. P. Chamola
	Teacher(s) (Alphabetically)	Prof. B. P. Chamola

COURSE OUTCOMES:		**COGNITIVE LEVELS**
After pursuing the above-mentioned course, the students will be able to:		
C101.1	explain the basic concepts and types of research	Understanding Level (C2)
C101.2	define a research problem, its formulation, methodologies and analyze research related information	Analyzing Level (C4)
C101.3	explain research ethics, understand IPR, patents and their filing related to their innovative works.	Understanding Level (C2)
C101.4	explain and analyze the statistical data and apply the relevant test of hypothesis in their research problems	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Research	What is research? Types of research. What is not research? How to read a	3

		Journal paper?	
2.	Report writing	How to write report? Use of Mendeley in report writing. How to write a research paper? Problem identification and solving.	4
3.	Ethics, IPR and Research methodologi es	Research ethics, patents, intellectual property rights, plagiarism regulation 2018. Steps in research process and common methodologies to attempt solution to research paper.	8
4.	Basics of statistics and probability distributions	Basic statistical concepts. Handling of raw data, Some common probability distributions.	7
5.	Test of hypothesis and regression analysis	Hypothesis testing. Parametric and non-parametric data, Introduction to regression analysis.	8
Total number of Lectures (Course delivery method: open ended discussion, guided self-study, lectures)			**30**

Evaluation Criteria Components
Maximum Marks Mid Term Examination 30

End Semester Examination 40
Assignments 30 (Quiz, Assignments)
Total 100

Project-based learning: Students divided in small groups will be assigned topics related to patents, intellectual property rights, plagiarism, and statistics. Students can write a report/review paper and find its similarity through plagiarism software available online. Students may collect data and test the relevant hypothesis. They may study some data set and do its regression analysis. The main purpose is to expose students to a wider arena of applicable knowledge of the subject.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Stuart Melville and Wayne Goddard, Research Methodology: An Introduction for Science & Engineering Students, Kenwyn, South Africa: Juta & Co. Ltd., 1996.

Kothari, C.R., Research Methodology: Methods and Techniques, New Age International, New Delhi, 2009.

Kumar, Ranjit, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, Sage Publications Ltd., 2005.
Ramappa, T., Intellectual Property Rights Under WTO, S. Chand, New Delhi, 2008.
Wayne Goddard and Stuart Melville, Research Methodology: An Introduction, Kenwyn, South Africa: Juta & Co, 2001.