Jaypee Institute of Information Technology

Integrated M.Tech. Biotechnology

Semester X

Course Descriptions

Detailed Syllabus

Lecture-wise Breakup

Course Code	17M12BT111	**Semester** Odd **(specify Odd/Even)**	**Semester** MTech I **Session** 2018 - 2019 **Month from** January to June
Course Name	Biosensors		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Prof. Sudha Srivastava
	Teacher(s) (Alphabetically)	Prof.Sudha Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain principle and working of biosensors and characterization techniques	Understand Level(C2)
CO2	Evaluate different methods of immobilization and their effect on biosensor performance	Evaluate Level (C5)
CO3	Analyze performance of a biosensor for disease diagnosis, environmental pollution, pathogen quantification	Analyze Level (C4)
CO4	Design strategy for fabrication of a given biosensor with high sensitivity and wide detection range	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction:**	Sensors and biosensors, definitions, types of sensors, markets, target analytes, glucose and other medical sensors	2
2.	**Biosensor Advancements and nanotechnology**	First-, second-, third generation biosensors, Nanotechnology and present day biosensors	3

3.	**Basic Design Considerations**	Calibration, dynamic Range, signal to noise, sensitivity, selectivity, interference.	3
4.	**The biological component**	Whole cell sensors, enzymes – sensing substrates or inhibitors, antibodies (Mab, Fab). And other binding proteins, oligonucleotides and aptamers.	3
5.	**Types of biosensors**	Optical biosensors, Electrochemical biosensors, Piezoelectric biosensor, Calorimetric biosensors	8
6.	**Immobilization method**	Non-covalent immobilization - entrapment and multipoint electrostatic attachment. Covalent attachment via thiol, amino and hydroxyl groups. Affinity interactions - avidin/biotin, , complementary oligonucleotides.	4
7.	**Techniques for sensing : Physical and chemical**	Absorbance, fluorescence, chemi/bioluminescence and phosphorescence, Surface Plasmon Resonance (SPR), quartz crystal microbalance, cyclic voltammetry	8
8.	**Sensor stabilization**	Storage and operational stability. Polyols, polymers and low Mw compounds as stabilizing agents for drying and long term storage. Stabilization mechanisms.	3
9.	**Applications**	Pharmaceutical**,** agricultural, food safety, biomedical applications, food processing: state of the field, market potential, unique design criteria and needs, current sensors in use.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Test, Presentation)
Total	**100**

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.	Ligler, F.S. and Rowe Taitt, C.A. 2002. Optical Biosensors: Present & Future. Elsevier, The Netherlands. ISBN: 0-444-50974-7.
2.	Yang, V.C. and T.T. Ngo. 2000. Biosensors and Their Applications. Kluwer Academic/Plenum Publishers, New York, NY. ISBN: 0-306-46087-4.
3.	Recent research articles

Detailed Syllabus

Lecture-wise Breakup

Course Code	17M12BT115	**Semester Odd (specify Odd/Even)**	**Semester X Session** 2018 -2019 **Month from** January to June
Course Name	Environmental Biotechnology		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Susinjan Bhattacharya
	Teacher(s) (Alphabetically)	Dr. Susinjan Bhattacharya

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO115.1	Utilize suitable methods to understand dynamics of microbial communities	Apply Level (C3)
CO115.2	Interpret environmental issues associated with industry, agriculture and medicine	Evaluating Level (C5)
CO115.3	Prioritize, and recommend environmentally safe practices for sustainable environmental management	Evaluating Level (C5)
CO115.4	Analyze problems pertaining to environmental pollution based on published literature	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	3	Global environmental issues and remedies from genetic manipulation of plants & microbes, Global warming, Green house gases and carbon sequestering	3
2.	5	Water pollution, land pollution, sources of pollution, risks of bioaccumulation, implications on biotic life & human health Biodegradable and non – biodegradable matter, toxicity testing, Biosensors, Bioindicators of pollution	5

3.	5	Land restoration and soil health, Engineering stress tolerant & herbicide & disease/pest resistant crops, Biotechnology of nitrogen fixation, Composting, Biofertilizers	5
4.	4	Bioremediation & Microbes, Degrees of biodegradation, Factors needed for biodegradation and adaptation, types of bioremediation (*in situ / ex situ*), GMOs superbugs, Biosorption, Biostimulation, Bioaggumentation, Oil spills - degradation of xenobiotics application of bioremediation in various environments/ecosystems; Effluent and water treatment; Phytoremediation and its applications	4
5.	4	Waste management (solid & liquid wastes), treatment of urban wastes, industrial wastes, Hospital wastes, Power plant wastes, Electronic waste, mineral wastes & radiological wastes.	4
6.	5	Renewable Bioenergy, Biofuels, Biomass applications, Applications of Biotechnology in various industries: paper & pulp, tanneries, distilleries, food processing & diary industry, Biofilters, Bioplastics, Biofilms in industry & environment, Case studies.	5
7.	4	Limitations of Pure Culture, Microbial Diversity and Variation in different extreme environments including human systems, Molecular tools to study diversity, Microarray techniques, application of genomics, transcriptomics and metabolomics to understand functional diversity of microbes	4
8.	4	Methods of Obtaining meta DNA from diverse environments, Habitat Selection 16S rRNA based amplification and Phylogenetics, Functional Sequencing, whole genome sequencing methods, use of phylogenetic markers for diversity analyses, Significance of Bioinformatics in understanding and analysis of Genomic Data, Databases and Software available for analysis of Metagenomic Data	4
9.	4	Function-Based Analyses of Microbial Communities, Acid Mine Drainage project, Sargasso Sea Metagenomic Survey, applying function based metagenome analysis to remediation etc.	4
10.	4	Environmental regulations for industry, EPA, ISO standards for environmental management, safety of transgenic plants & animals and their impact on environment	4

Total number of Lectures	**42**

Evaluation Criteria

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

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.	"Environmental Biotechnology" by A. Sragg, Oxford University Press, Second edition Reprint 2005, ISBN 0-19-926867-3
2.	"Enviornmental Biotechnology and Application" by **G. Evans**, J.C. Furlong, John Wiley and Sons Ltd.
3.	"Environmental Biotechnology: Basic concepts and Applications" by **InduShekhar Thakur**, IK International, 2006
4.	"Principles of Gene manipulation and Genomics", by SB Primrose & RM Twyman, Seventh edition, Blackwell publishing
5.	"The New Science Of Metagenomics Revealing The Secrets Of Our Microbial Planet", The National Academies Press, Washington, Dc
6.	Refereed papers from scientific journals

Detailed Syllabus

Lecture-wise Breakup

Course Code	17M12BT116	**Semester** Odd	**Semester** X **Session** 2018 -2019 **Month from** July to December
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**
CO1	Explain regulatory markets and agencies; preclinical and clinical trials	Understanding (Level 2)
CO2	Analyze the guidelines for approvals of new drugs/biologics	Analyzing (Level 4)
CO3	Compare innovator and generic pharmaceutical industry with Patent and Non patent exclusivity	Evaluating (Level 5)
CO4	Interpret ICH guidelines applicable to drugs and biotechnology based therapeutic products.	Understanding (Level 2)
CO5	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, Europian Union TGA, Australia	**2**
2.	**Introduction To Pharmacopoeias and Monographs**	Indian Pharmacopoeia (IP) British Pharmacopoeia (BP)	**2**

		United Sates Pharmacopoeia (USP) International Pharmacopoeia (Int. Ph.) European Pharmacopoeia (Eur. Ph.)	
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 guildines, 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 Studies**	Relevant Case studies	**4**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Test, Assignment I and II)

Total	**100**

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

Detailed Syllabus

Lecture-wise Breakup

Course Code	**14M1NBT334/17 M12BT118**	**Semester Odd**	**Semester III**. **Session** 2018 -2019 **Month from**June to December
Course Name	**Product Development in Biotechnology**		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. NeerajWadhwa
	Teacher(s) (Alphabetically)	Dr. NeerajWadhwa

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Outline various processes relevant for Biobusiness	**Understand (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- glasswares chemical requiremen-- construction,techniquesin culturing and export abroad, Vermitechnology, Mushroom cultivation, single cell protein, Biofertilizer technology-production, Textile	**10**

		processing, leather treatment, Detergent industry, bakery, diary Pharmaceutical drug development, Medical device product development ,Technology product development Other biotech product development, such as biofuels, bioengineered foods, etc.- commercialization of Bakery and dairy products	
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. b.Production of Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers Biodiesel. Cheese, Beer, SCP & Mushroom culture, Bioremediation. c.Production of recombinant proteins having therapeutic and diagnostic applications, vaccines. Bioprocess strategies in Plant Cell and Animal Cell culture. d.Biotransformation applications of enzymes - Hydrolytic- Ester bond, Amide, Epoxides, Nitriles, Reduction reactions –aldehydes, Ketones, C=C, Oxidation reactions – Alkanes, Aromatic, Baeyer-Villiger, Enzymes in organic synthesis – esters, amide, peptide , Modified and Artificial Enzymes , Catalytic antibodies	**12**
4.	**Intellectual property, Bioethics,legal issues**	Patents , Confidentiality , Licensing agreements Business Development/Licensing, Strategy Marketing and public perception in product development, genetically modified products and organism- transgenic products licencing and branding concerns	**5**

5.	**Biobusiness plans**	Concerns and oppurtunities, Bank loan and finance strategy, Budget planning,Policy and regulatory concerns,Corporate partners marketing- Model project Case studies of different industries and strategic planning	**10**
6.	**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**
7.	**Business in the context of biotechnology** **Entrepreneurship-**	Science/development, the idea and its development , Plant tissue culture lab-equipment- glasswares chemical requiremen-- construction,techniquesin culturing and export abroad, Vermitechnology, Mushroom cultivation, single cell protein, Biofertilizer technology-production, Textile processing, leather treatment, Detergent industry, bakery, diary Pharmaceutical drug development, Medical device product development ,Technology product development Other biotech product development, such as biofuels, bioengineered foods, etc.- commercialization of Bakery and dairy products	**10**
8.	**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. b.Production of Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers Biodiesel. Cheese, Beer, SCP & Mushroom culture, Bioremediation. c.Production of recombinant proteins having therapeutic and diagnostic applications, vaccines. Bioprocess strategies in Plant Cell and Animal Cell culture. d.Biotransformation applications of enzymes - Hydrolytic- Ester bond, Amide, Epoxides, Nitriles, Reduction reactions –aldehydes, Ketones, C=C, Oxidation reactions – Alkanes, Aromatic, Baeyer-	**12**

		Villiger, Enzymes in organic synthesis – esters, amide, peptide , Modified and Artificial Enzymes , Catalytic antibodies	
9.	**Intellectual property, Bioethics,legal issues**	Patents , Confidentiality , Licensing agreements Business Development/Licensing, Strategy Marketing and public perception in product development, genetically modified products and organism- transgenic products licencing and branding concerns	**5**
		Total number of Lectures	**42**

Evaluation Criteria

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

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. etal., "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 , Biotransformations in Organic Chemistry, IV edition , Springer

6.	Dubey, R.C. "A Textbook of Biotechnology" S.Chand& Co. Ltd., 2006.Trevor Palmer , Enzymes II edHorwood 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." Biobusiness"MJP Publication Chennai India 2009
11.	Cynthia Robins," The business of Biotechnology". UK Harper Collins 2001

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**17M12BT119**	**Semester : ODD**	**Semester : X Session : 2018-2019** **Month from : July to December**
Subject Name	**PHYTOTHERAPEUTICS AND PHARMACOLOGY**		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	1. Dr.Vibha Rani
	Teacher(s) (Alphabetically)	1. 2.

COURSE DESCRIPTION Introduction of Indian medicinal plants and natural therapeutics; Classes of secondary metabolites; Analysis of phytomolecules – quantitative and qualitative; Purification methods - HPLC, GC-MS, FTIR, NMR; Phytomolecules' structure and their function relationship; Therapeutic applications and mechanism of action of secondary metabolites; Herbal therapies for diseases affecting human health such as respiratory, urinary, cardiovascular, cancer, neurodegenerative diseases, etc.; Current aspects of phytomedicine on toxicity and clinical analyses; Case studies.

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 phytomolecules	**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 Ayurpharmacoepidemiology	**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**		2
2	**Medicinal Plants Metabolites**	Introduction to metabolites Secondary metabolites, properties and beneficial aspects.	4
3	**Isolation technique**	Isolation from medicinal plants.	4

	extraction procedure	Isolation from aromatic plants.	
4	**Characterization technique**	Qualitative and quantitative Analysis Gas Chromatogrophy High Performance Liquid Chromatography: (HPLC) High Performance Thin Layer Chromatography: (HPTLC)	4
5	**Structure functional relationship**	Mechanism of Action Unidentified Therapeutic Intakes Factors That Affect Metabolism	4
6	**Therapeutic Application**	Plants used in respiratory system. Plants used in urinary system. Plants used with antimicrobial activity. Plants used with Plants used in dermatology. Plants used in cardiovascular system. Plants used in romatology.	8
7	**Toxicity Issue and Clinical Trials**	Current aspects of phytomedicine on toxicity and clinical trials	6
9	**Case studies**		8
10	**Potential risks associated and future aspects**		2
12			
		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, Case studies 1, 2& 3)
Total	**100**

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 Bioactives and Drug Discovery: Principles, Practice, and Perspectives. ValdirCechinel-Filho (Ed.). 2012 John Wiley & Sons, Inc.
2.	Phytotherapeutics (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.

Detailed Syllabus

Lab-wise Breakup

Course Code	**17M15BT111**	**Semester** Odd **(specify Odd/Even)**	**Semester** I **Session** 2018 -2019 **Month from** July to December
Course Name	**Biotechniques Lab-I**		
Credits	3	**Contact Hours**	6

Faculty (Names)	**Coordinator(s)**	Prof. PammiGauba
	Teacher(s) (Alphabetically)	Dr. Indira P. Sarethy, Prof. PammiGauba, Dr.ReemaGabrani, Dr. Shweta Dang, Dr.Vibha Rani

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Apply basic analytical techniques in biotechnology	Apply Level (C3)
CO2	Develop skills in molecular biology techniques	Apply Level (C3)
CO3	Examine and analyse gene expression	Analyze (Level C4)
CO4	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 learn about basic calculations/mole concepts; To learn about UV-VIS spectrometry/ plot calibration curves and calculate analyte concentration, to prepare drug-loaded nanoparticles; to analyze entrapment efficiency via UV-VIS Spectrophotometer	3
2.	Molecular biology techniques	To isolate plasmid DNA from bacterial cells; separate and visualize DNA bands by agarose gel electrophoresis;	3
3.	Gene expression techniques	Designing primers for amplification of gene of interest by PCR	3
4.	Purification techniques	To obtain antimicrobial compound from bacterial culture; to purify the antimicrobial compound by column	3

		chromatography; use of bioactivity-guided fractionation to analyse and quantitate the compound	
		Total	**12**

Evaluation Criteria

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

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.	Introduction to Biotechnology, Laboratory Manual: http://www.austincc.edu/awheeler/Files/BIOL%201414%20Fall%202011/BIOL1414_Lab%20Manual_Fall%202011.pdf
2.	Frederick M. Ausubel, 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

Detailed Syllabus

Lecture-wise Breakup

Course Code	**17M17BT211**	**Semester** ODD	**Semester** X and M.Tech III sem **Session** 2018-2019 **Month from** July-December
Course Name	**Seminar and Term Paper**		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	DrGarimaMathur

	Teacher(s) (Alphabetically)	Dr GarimaMathur

COURSE OUTCOMES		**COGNITIVE LEVELS**
C211.1	Make use of existing literature to define a research problem.	Applying Level (C3)
C211.2	Survey the available scientific resources & databases to address the problem	Analyzing Level (C4)
C211.3	Evaluate and critique acquired knowledge	Evaluate Level (C5)
C211.4	Conclude through oral and written scientific presentations	Evaluate Level (C5)

Detailed Syllabus

Lecture-wise Breakup

Course Code	**17M17BT212**	**Semester** ODD	**Semester** X and M.Tech III sem **Session** 2019-2020 **Month from** July-December
Course Name	**Project Based Learning-II**		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	DrAshwaniMathur
	Teacher(s) (Alphabetically)	DrAshwaniMathur

COURSE OUTCOMES		**COGNITIVE LEVELS**
C201.1	Compare and contrast the existing literature and interpret the research problem	Understanding Level 2
C201.2	Make use of biotechnological and allied fields to explore different strategies	Applying Level 3
C201.3	Designing the research strategy	Create Level Level 6
C201.4	Conclude the research finding through presentation and technical report	Analyzing Level 4

Detailed Syllabus

Lecture-wise Breakup

Course Code	**18M12BT211**	**Semester** ODD **(specify Odd/Even)**	**Semester** X **Session** 2019 -2020 **Month from**July toDecember
Course Name	**PUBLIC HEALTH ECONOMICS AND POLICY**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	DR. ASHWANI MATHUR
	Teacher(s) (Alphabetically)	DR. ASHWANI MATHUR

COURSE OUTCOMES		**COGNITIVE LEVELS**
C141.1	Explain Government policies , socio-economic conditions and research methods in Public Health	Understanding (Level 2)
C141.2	Explain fundamentals of disease epidemiology	Understanding (Level 2)
C141.3	Applying computational tools for determining health indicators from primary and secondary data	Applying (Level 3)
C141.4	Analysis of the role of health care in policy making	Analyzing (Level 4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Importance of Public Health	Introduction to Public Health, Health Promotion and Disease Prevention, Relevance of policy response in public health, Public health research methods – qualitative and quantitative methods, Role of ethics in research	**6**
2.	Basic Epidemiology	Introduction to Fundamentals of Epidemiology; Disease-History, prevention and intervention; measurement of occurrence, effect and impact; cohort studies	**7**
3.	Statistical Tool in Public Health	Introduction to probability, Probability Distribution, Hypothesis testing, Baye's Theorem, Continuous and	**5**

		categorical outcome	
4.	Health Economics and micro economics	Economics and Health; Use and understanding of Universal indicators, HDI, LE, Mortality and Morbidity; Principles of economics in health	**6**
5.	Economic Evaluation	Welfare economics, monetary value of health changes; revealed and expressed preference approach, cost benefit analysis, cost effectiveness analysis	**6**
6.	Health Policy Analysis	Policy analysis process; health care and health policy; Role of government in policy making; Policy analysis process-identification, evaluation (technology assessment; economic viability)	**7**
7.	Health financing	Cost behaviour and break even analysis, depreciation concept, health as inventory and investment	**5**
		Total number of Lectures	42

Evaluation Criteria

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

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.	**Schneider, M-J. Introduction to Public Health. Jones and Bartlett Publishers, USA**
2.	**Bhattacharya, J., Hyde, T., Tu, P. Health Economics. Palgrave Macmillan**
3.	**Drummond M., et al. Methods for the Economic Evaluation of health care programmes. Oxford University Press**
4.	**Johannesson, Magnus. Theory and Methods of Economic Evaluation of Healthcare. Springer Science Business Media**