Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

CURRICULUM & SYLLABUS

(2021-REGULATION)

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

(INTERNET OF THINGS AND CYBER SECURITY INCLUDING BLOCK CHAIN TECHNOLOGY)

(ACADEMIC YEAR – 2021- 2022 ONWARDS)

DEPARTMENT

OF

COMPUTER SCIENCE AND ENGINEERING

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

DECLARATION

I, **Dr. S. GEETHA**, Head of Computer Science and Engineering Department, hereby declare that this copy of the syllabus (B.Tech –Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)-Full Time 2021 Regulation is the final version which is being taught in the class and uploaded in our University website. I assure that the Syllabi available in our University website is verified and found correct. The Curriculum and Syllabi have been ratified by our Academic Council / Vice Chancellor.

Date: **Signature**

Department of Computer Science and Engineering

I SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BEN18001	Technical English –I	Ty	1	0/0	2/0	2
2	BMA18001	Mathematics – I	Ty	3	1/0	0/0	4
3	BPH18001	Engineering Physics –I	Ty	2	0/1	0/0	3
4	BCH18001	Engineering Chemistry –I	Ty	2	0/1	0/0	3
5	BES18001	Basic Electrical & Electronics Engineering	Ty	2	0/1	0/0	3
6	BES18002	Basic Mechanical & Civil Engineering	Ty	2	0/1	0/0	3
PRACTICALS*							
1	BES18L01	Basic Engineering Workshop	Lb	0	0/0	2/0	1
2	BES18ET1	Orientation to Entrepreneurship & Project Lab	ETL	0	0/0	2/0	1
						Credits Sub Total	**20**

P

II SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BMA18003	Mathematics – II	Ty	3	1/0	0/0	4
2	BPH18002	Engineering Physics –II	Ty	2	0/1	0/0	3
3	BCH18002	Engineering Chemistry –II	Ty	2	0/1	0/0	3
4	BES18003	Environmental Science*	Non credit course				
PRACTICALS*							
1	BEN18ET1	Communication Lab	ETL	1	0/0	2/0	1
2	BES18ET2	Basic Engineering Graphics	ETL	1	0/0	2/0	2
3	BES18L02	Integrated Physical Science lab	Lb	0	0/0	2/0	1
4	BES18ET3	C Programming and Lab	ETL	1	0/0	2/0	2
						Credits Sub Total	**16**

TOTAL CREDITS: 36

C: Credits L: Lecture T: Tutorial S.Lr: Supervised Learning P: Problem / Practical R: Research Ty/Lb/ETL: Theory /Lab/Embedded Theory and Lab * Internal Evaluation

Department of Computer Science and Engineering

III SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
1	BMA18008	Discrete Mathematics	Ty	3	1/0	0/0	4
2	BCS18013	Data Structures	Ty	3	0/0	0/0	3
3	BCS21B01	IOT Architecture and its Protocol	Ty	3	0/1	0/0	4
4	BCS18014	Computer Organization and Architecture	Ty	3	0/0	0/0	3
5	BEC18I01	Digital Systems	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BCS18L01	Data Structures Lab	Lb	0	0/0	3/0	1
2	BCS21BL1	Internet of Things Lab-I	Lb	0	0/0	3/0	1
3	BEC18IL1	Digital System Lab	Lb	0	0/0	3/0	1
4	BHS20ET5	Universal Human Values 2: Understanding Harmony	ETL	2	1/0	0/0	3
Credits Sub Total							**23**

IV SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
1	BMA18016	Statistics for Computer Engineers	Ty	3	1/0	0/0	4
2	BCS18015	DataBase Management Systems	Ty	3	0/0	0/0	3
3	BEC18I02	Microprocessors and Microcontrollers	Ty	3	0/0	0/0	3
4	BCS21B02	Sensors and Actuator Devices for IOT	Ty	3	0/0	0/0	3
5	BHS18NC1/BHS18NC2	TheIndian Constitution*/ TheIndian Traditional Knowledge*	Ty	2	0/0	0/0	NC
PRACTICALS*							
1	BCS18ET1	Java Programming	ETL	1	0/1	3/0	3
2	BCS18L03	Database Management Systems Lab	Lb	0	0/0	3/0	1
3	BCS21BL2	Internet of Things Lab-II	Lb	0	0/0	3/0	1
4	BEC18IL2	Microprocessors and Microcontrollers Lab	Lb	0	0/0	3/0	1
5	BCS18TS1	Technical Skill I	Lb	0	0/0	3/0	1
6	BEN18SK1	Soft Skill I (Career & Confidence Building)	ETL	0	0/0	3/0	1
Credits Sub Total							**21**

Department of Computer Science and Engineering

C: Credits L: Lecture T: Tutorial S.Lr: Supervised Learning P: Problem / Practical R: Research Ty/Lb/ETL: Theory /Lab/Embedded Theory and Lab * Internal Evaluation

V SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
1	BCS18006	Operating Systems	Ty	3	0/0	0/0	3
2	BCS18007	Computer Networks	Ty	3	0/0	0/0	3
3	BCS21B03	Fundamentals of Block Chain Technology	Ty	3	0/0	0/0	3
4	BXX18OEX	Open Elective I	Ty	3	0/0	0/0	3
5	BCS18008	System Software and Principles of Compiler Design	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BCS18ET2	Computer Graphics	ETL	1	0/1	3/0	3
2	BCS18L05	Network Programming Lab	Lb	0	0/0	3/0	1
3	BCS18L06	Operating Systems Lab	Lb	0	0/0	3/0	1
4	BCS18L07	System Software and Compiler Design Lab	Lb	0	0/0	3/0	1
5	BCS18TS2	Technical Skill II	Lb	0	0/0	3/0	1
						Credits Sub Total	**22**

VI SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
1	BCS18009	Object Oriented Software Engineering	Ty	3	1/0	0/0	4
2	BIT18003	Web Technology and Web Services	Ty	3	0/0	0/0	3
3	BCS21B04	Blockchain And Cryptocurrency Technologies	Ty	3	0/0	0/0	3
4	BXX18OEX	Open Elective II	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BCS18ET3	PHP/MySQL	ETL	1	0/1	3/0	3
2	BCS18L08	Object Oriented Software Engineering Lab	Lb	0	0/0	3/0	1
3	BIT18L03	Web Technology and Web Services Lab	Lb	0	0/0	3/0	1
4	BEN18SK2	Soft Skill II (Qualitative and Quantitative Skills)	ETL	0	0/0	3/0	1
5	BCS18L09	Mini Project/In plant Training/Industrial training	Lb	0	0/0	3/0	1
6	BCS18TS3	Technical Skill III	Lb	0	0/0	3/0	1
						Credits Sub Total	**21**

Department of Computer Science and Engineering

C: Credits L: Lecture T: Tutorial S. Lr : Supervised Learning P : Problem / Practical R : Research Ty/Lb/ETL: Theory/Lab/Embedded Theory and Lab *Internal evaluation

VII SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
1	BCS18010	Data Warehousing and Data Mining	Ty	3	0/0	0/3	4
2	BCS21B05	Cyber Security Forensics, Investigation & Laws	Ty	3	0/0	0/0	3
3	BCS18011	Dot Net Framework	Ty	3	1/0	0/0	4
4	BMG18002	Management Concepts and Organizational Behavior	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BXX18OLX	Open Lab	Lb	0	0/0	3/0	1
2	BCS18L11	Data Mining Lab	Lb	0	0/0	3/0	1
3	BCS18L12	Dot Net Lab	Lb	0	0/0	3/0	1
4	BCS18L13	Project Phase – I	Lb	0	0/0	3/3	2
5	BHS18FLX	Foreign Language	Lb	0	0/0	3/0	1
						Credits Sub Total	**20**

VIII SEMESTER							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
1	BCS21BEXX	Elective -I	Ty	3	0/0	0/0	3
2	BCS18012	Open Source Scripting Languages	Ty	3	0/0	0/0	3
3	BCS21BEXX	Elective -II	Ty	3	0/0	0/0	3
PRACTICALS*							
1	BCS18L14	Project (Phase – II)	Lb	0	0/0	12/12	8
						Credits Sub Total	**17**

C: Credits L: Lecture T: Tutorial S.Lr: Supervised Learning P: Problem / Practical R: Research Ty/Lb/ETL: Theory /Lab/Embedded Theory and Lab * Internal Evaluation

Department of Computer Science and Engineering

Credit Summary

Semester : 1 : 20
Semester : 2 : 16
Semester : 3 : 23
Semester : 4 : 21
Semester : 5 : 22
Semester : 6 : 21
Semester : 7 : 20
Semester : 8 : 17
Total Credits : 160

Department of Computer Science and Engineering

ELECTIVE –I&II (IOT,CS AND BT)							
S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb /ETL	L	T/ S Lr	P/R	C
1	BCS21BE01	Deep Learning	Ty	3	0/0	0/0	3
2	BCS21BE02	Privacy and Security in IOT	Ty	3	0/0	0/0	3
3	BCS21BE03	Ethical Hacking	Ty	3	0/0	0/0	3
4	BCS21BE04	Vulnerability Analysis and Penetration Testing	Ty	3	0/0	0/0	3
5	BCS21BE05	Design and Development of Block Chain Applications	Ty	3	0/0	0/0	3
6	BCS21BE06	Cyber Security	Ty	3	0/0	0/0	3
7	BCS21BE07	Information Security Analysis and Audit	Ty	3	0/0	0/0	3
8	BCS21BE08	Industrial And Medical IoT	Ty	3	0/0	0/0	3
9	BCS21BE09	Cyber Security Risk Management And Mitigation	Ty	3	0/0	0/0	3
10	BCS21BE10	IOT Enabled System Design	Ty	3	0/0	0/0	3
11	BCS21BE11	Programming For Iot Boards	Ty	3	0/0	0/0	3
12	BCS21BE12	Fog And Edge Computing	Ty	3	0/0	0/0	3
13	BCS21BE13	Cyber And Digital Forensics	Ty	3	0/0	0/0	3
14	BCS21BE14	Smart Sensor Technology	Ty	3	0/0	0/0	3

Department of Computer Science and Engineering

Open Electives -CIVIL							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BCE18OE1/BCE20OE1	Water Pollution And Its Management	Ty	3	0/0	0/0	3
2	BCE18OE2/BCE20OE2	Environment,HealthAndSafety InIndustries	Ty	3	0/0	0/0	3
3	BCE18OE3/BCE20OE3	Green Building And Vastu Concepts	Ty	3	0/0	0/0	3
4	BCE18OE4/BCE20OE4	Climate Change And Sustainable Development	Ty	3	0/0	0/0	3
5	BCE18OE5/BCE20OE5	Intelligent Transportation Systems	Ty	3	0/0	0/0	3
6	BCE18OE6/BCE20OE6	Geographical Information System And Mapping	Ty	3	0/0	0/0	3
7	BCE18OE7/BCE20OE7	Industrial Pollution Prevention And Cleaner Production	Ty	3	0/0	0/0	3
8	BCE18OE8/BCE20OE8	Air Pollution And Control	Ty	3	0/0	0/0	3
Open Electives Lab							
1	BCE18OL1/BCE20OL1	Building Drawing Practice Using Autocadd	LB	0	0/0	3/0	1
2	BCE18OL2/BCE20OL2	GeographicalInformationSystemAnd MappingLab	LB	0	0/0	3/0	1
3	BCE18OL3/BCE20OL3	Environmental Engineering Laboratory	LB	0	0/0	3/0	1

OPEN ELECTIVES- CHEMICAL ENGINEERING							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BCT18OE1/BCT20OE1	Fundamentals Of Nanoscience	Ty	3	0/0	0/0	3
2	BCT18OE2/BCT20OE2	Electrochemical Engineering	Ty	3	0/0	0/0	3
3	BCT18OE3/BCT20OE3	Alternative Fuels And Energy System	Ty	3	0/0	0/0	3
4	BCT18OE4/BCT20OE4	Petrochemical Unit Processes	Ty	3	0/0	0/0	3
5	BCT18OE5/BCT20OE5	Principles Of Desalination Technologies	Ty	3	0/0	0/0	3
6	BCT18OE6/BCT20OE6	Piping Design Engineering	Ty	3	0/0	0/0	3
7	BCT18OE7/BCT20OE7	E-Waste Management	Ty	3	0/0	0/0	3

Department of Computer Science and Engineering

OPEN ELECTIVE- Electrical and Electronics Engineering							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/ R**	**C**
1	BEE18OE1/BEE20OE1	Electrical Safety for Engineers	Ty	3	0/0	0/0	3
2	BEE18OE2/BEE20OE2	Energy Conservation Techniques	Ty	3	0/0	0/0	3
3	BEE18OE3/BEE20OE3	Electric Vehicle Technology	Ty	3	0/0	0/0	3
4	BEE18OE4/BEE20OE4	Biomedical Instrumentation	Ty	3	0/0	0/0	3
5	BEE18OE5/BEE20OE5	Introduction to Power Electronics	Ty	3	0/0	0/0	3
6	BEE18OE6/BEE20OE6	Industrial Instrumentation	Ty	3	0/0	0/0	3
7	BEE18OE7/BEE20OE7	Solar Energy Conversion System	Ty	3	0/0	0/0	3
8	BEE18OE8/BEE20OE8	Wind Energy Conversion System	Ty	3	0/0	0/0	3
9	BEE18OE9/BEE20OE9	Energy Storage Technology	Ty	3	0/0	0/0	3
OPEN LAB							
1	BEE18OL1/BEE20OL1	Transducer Lab	Lb	0	0/0	3/0	1
2	BEE18OL2/BEE20OL2	PLC and SCADA Lab	Lb	0	0/0	3/0	1
3	BEE18OL3/BEE20OL3	Electrical Maintenance Lab	Lb	0	0/0	3/0	1
4	BEE18OL4/BEE20OL4	Power Electronics Lab	Lb	0	0/0	3/0	1
5	BEE18OL5/BEE20OL5	Bio Medical Instrumentation Lab	Lb	0	0/0	3/0	1

	OPEN ELECTIVES-Biotechnology						
S.No	**Course Code**	**Course Title**	**Ty/Lb/ETL**	**L**	**T/SLr**	**P/R**	**C**
1.	BBT18OE1/BBT20OE1	Food and Nutrition	Ty	3	0/0	2/0	3
2.	BBT18OE2/BBT20OE2	Human Physiology	Ty	3	0/0	0/0	3
3.	BBT18OE3/BBT20OE3	Clinical Biochemistry	Ty	3	0/0	0/0	3
4.	BBT18OE4/BBT20OE4	Bioprocess Principles	Ty	3	0/0	0/0	3
5.	BBT18OE5/BBT20OE5	Biosensors and biomedical Devices in Diagnostics	Ty	3	0/0	0/0	3
6.	BBT18OE6/BBT20OE6	Basic Bioinformatics	Ty	3	0/0	0/0	3
	Open Labs						
1.	BBT18OL1/BBT20OL1	Basic Biochemistry Lab	Lb	0	0/0	3/0	1
2.	BBT18OL2/BBT20OL2	Basic Bioprocess Lab	Lb	0	0/0	3/0	1
3.	BBT18OL3/BBT20OL3	Basic Microbiology Lab	Lb	0	0/0	3/0	1
4.	BBT18OL4/BBT20OL4	Basic Bioinformatics Lab	Lb	0	0/0	3/0	1

Department of Computer Science and Engineering

OPEN ELECTIVES- MECHANICAL ENGINEERING							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BME18OE1/BME20OE1	Industrial Engineering	Ty	3	0/0	0/0	3
2	BME18OE2/BME20OE2	Finite Element Method	Ty	3	0/0	0/0	3
3	BME18OE3/BME20OE3	AutomobileEngineering	Ty	3	0/0	0/0	3
4	BME18OE4/BME20OE4	Industrial Robotics	Ty	3	0/0	0/0	3
5	BME18OE5/BME20OE5	Renewable Sources Of Energy	Ty	3	0/0	0/0	3
6	BME18OE6/BME20OE6	Refrigeration And Air Conditioning	Ty	3	0/0	0/0	3
7	BME18OE7/BME20OE6	Composite Materials	Ty	3	0/0	0/0	3
Open Labs							
1	BME18OL1/BME20OL1	Internalcombustion Engines & steamlab	Lb	0	0/0	3/0	1
2	BME18OL2/BME20OL2	Computer aided design And analysis lab	Lb	0	0/0	3/0	1
3	BME18OL3/BME20OL3	Mechanical measurements & metallurgy lab	Lb	0	0/0	3/0	1

Department of Computer Science and Engineering

OPEN ELECTIVES- Dr APJ Abdul Kalam Center for Research							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**
1	BMG18OE1/BMG20OE1/ BMG13E12/BMG20E12	Technical Entrepreneurship	ETL	2	0/1	2/0	3
2	BMG18OE2/BMG20OE2	Advanced Program in Entrepreneurship	ETL	2	0/1	2/0	3

OPEN ELECTIVES - ELECTRONICS AND COMMUNICATION ENGINEERING							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
1	BEC18OE1/BES20OE1	Internet of Things and its Applications	Ty	3	0/0	0/0	3
2	BEC18OE2/BES20OE2	Cellular Mobile Communication	Ty	3	0/0	0/0	3
3	BEC18OE3/BES20OE3	Satellite and its Applications	Ty	3	0/0	0/0	3
4	BEC18OE4/BES20OE4	Fundamentals of Sensors	Ty	3	0/0	0/0	3
5	BEC18OE5/BES20OE5	Basics of Microprocessors and Microcontrollers	Ty	3	0/0	0/0	3
6	BEC18OE6/BES20OE6	Industry 4.0 Concepts	Ty	3	0/0	0/0	3

OPEN LABS							
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
1	BEC18OL1/BEC20OL1	Sensors and IoT Lab	Lb	0	0/0	3/0	1
2	BEC18OL2/BEC20OL2	Robotics Control Lab	Lb	0	0/0	3/0	1
3	BEC18OL3/BEC20OL3	Basics of MATLAB	Lb	0	0/0	3/0	1

Department of Computer Science and Engineering

I Year B.Tech Full Time 2018 Regulation Curriculum & Syllabus

DEPARTMENT OF COMPUTER SCIENCE

Subject Code	Subject Name : TECHNICAL ENGLISH	Ty/ Lb/ ETL	L	T/SLr	P/R	C
BEN18001	Prerequisite : None	Ty	1	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Strengthen their vocabulary in both technical and business situations
- Get practice in functional grammar
- Learn the effective way of corresponding with officials
- Learn to give instructions, suggestions, recommendations and comprehend and infer the information from the given passages.
- Train learners in organized academic and professional writing

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Recall basic grammar, spelling and phonetics concept.(L1,L2)
CO2	Discuss ideas and concepts in groups.(L2,L3,L4)
CO3	Interpret charts, diagrams, reports and advertisements.(L3,L4)
CO4	Analyse and evaluate scientific and technical concepts for organized oral and written presentation (L3,L4)
CO5	Apprise, argue and support using critical judgments on any given topic(L3,L4)

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1				3					3		3
CO2	3	3	3	3	1	3	3	1	3	3	1	3
CO3	3	2	1	3	3	2	2		2	3		3
CO4	3	3	3	3	1	2	1	3	2	3	1	3
CO5	1	2	2	3	3	2	2		3	3	2	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1		1		
CO2	1	2	1	2
CO3	1	2	1	2
CO4	1	2	2	2
CO5	1	2	2	1

3/2/1 Indicates Strength of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
			√						

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/SLr	P/R	C
BEN18001	**TECHNICAL ENGLISH - I**	Ty	1	0/0	2/0	**2**

UNIT I VOCABULARY BUILDING 6HRS

The concept of Word Formation-Root words and affixes from foreign languages and their use in English to form derivatives.-Homophones- Words often confused-Verbal analogy

UNIT II BASIC WRITING SKILLS 6HRS

Using Idioms and phrases in sentences-Sentence structures: statements, interrogative and imperative-Use of Conditional/if' clauses in sentences-Importance of proper punctuation-Creating coherence with sentence markers-Organizing coherent paragraphs in essays

UNIT III IDENTIFYING COMMON ERRORS IN WRITING 6 HRS

Subject-verb agreement-Noun-pronoun agreement- Misplaced modifiers-Articles-Prepositions- Redundancies and Clichés

UNIT IV WRITING PRACTICE- NATURE AND STYLE OF TECHNICAL WRITING 6 HRS

Describing Gadgets- Defining Concepts-Classifying data-Comprehension-Essay Writing-Informal and Formal Letter Writing:

UNIT V ORAL COMMUNICATION AND INTERACTIVE LEARNING 6HRS

(This unit involves interactive practice sessions in Language Lab)
Activities to develop knowledge in Word formation, Vocabulary and analytical thinking-Instructions and –Recommendations-Formal and Informal Registers in Speech-Listening and taking notes

Total Hours: 30

TEXT BOOK :

Quest : A Textbook of Communication Skills, Vijay Nicole, 2017.
Pushkala, R, Padmasani Kannan S, Anuradha V, Chandrasena M Rajeswaran

REFERENCE BOOKS:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.
(ii) *Remedial English Grammar.* F.T. Wood. Macmillan.2007
(iii)*On Writing Well.*William Zinsser. Harper Resource Book. 2001
(iv) *Study Writing.* Liz Hamp-Lyons and Ben Heasly.Cambridge University Press. 2006.
(v) *Communication Skills*. Sanjay Kumar and Pushp Lata.Oxford University Press. 2011.
(vi) *Exercises in Spoken English.* Parts.I-III. CIEFL, Hyderabad. Oxford University Press
(vi) Pronunciation in Use ,Mark Hancock. Cambridge University Press. 2012

Department of Computer Science and Engineering

Subject Code	Subject Name : **MATHEMATICS-I**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BMA18001	Prerequisite : None	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Apply the Basic concepts in Algebra
- Use the Basic concepts in Matrices
- Identify and solve problems in Trigonometry
- Understand the Basic concepts in Differentiation
- Apply the Basic concepts in Functions of Several variables

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Demonstrate knowledge of Basic concepts of Mathematics science & Engineering mathematics (L1,L2,L3)
CO2	Calculate the required parameters using basic mathematical theorems, laws and formulae (L2,L3,L4)
CO3	Apply mathematical techniques to solve problems (L2,L3,L4)
CO4	Examine the relevant methods, tools and techniques to provide solutions(L1,L2,L3,L4)
CO5	Combine scientific & math principles, apply to real time problems for accurate results(L3,L4)

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	2	2	1		3	3		3
CO2	3	3	1	2	3	1	1			1		3
CO3	3	3	2	2	3	2	1		2	3	1	2
CO4	3	3	2	2	1	2	1	1	2	3	1	2
CO5	3	3	2	2	2	2	1	1	2	2	1	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1
CO2	1	3	1	1
CO3	2	3	1	1
CO4	2	3	1	1
CO5	2	3	1	1

3/2/1 Indicates Strength Of Correlation, 3 –High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills

	√								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BMA18001	MATHEMATICS – I	Ty	3	1/0	0/0	4

UNIT I ALGEBRA 12Hrs

Binomial, Exponential, Logarithmic Series (without proof of theorems) – Problems on Summation, Approximation and Coefficients.

UNIT I I MATRICES 12Hrs

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values – Cayley - Hamilton theorem(without proof) – Orthogonal reduction of a symmetric matrix to Diagonal form.

UNIT I II TRIGONOMETRY 12Hrs

Expansions of Sin nθ, Cos nθ in powers of Sinθ and Cosθ – Expansion of Tan nθ – Expansions of $\text{Sin}^n\theta$ and $\text{Cos}^n\theta$ in terms of Sines and Cosines of multiples of θ – Hyperbolic functions – Separation into real and imaginary parts.

UNIT I V DIFFERENTIATION 12Hrs

Basic concepts of Differentiation – Elementary differentiation methods – Parametric functions – Implicit function –Leibnitz theorem(without proof) – Maxima and Minima – Points of inflection.

UNIT V FUNCTIONS OF SEVERAL VARIABLES 12Hrs

Partial derivatives – Total differential – Differentiation of implicit functions – Taylor's expansion – Maxima and Minima by Lagrange's Method of undetermined multipliers – Jacobians.

Total Hours : 60

TEXT BOOKS:

1. Kreyszig E., *Advanced Engineering Mathematics (10 th ed.)*, John Wiley & Sons, (2011).
2. Veerarajan T., *Engineering Mathematics (for first year)*, Tata McGraw Hill Publishing Co., (2008).

REFERENCE BOOKS:

1. *Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012).*
2. *John Bird, Basic Engineering Mathematics (5th ed.), Elsevier Ltd, (2010).*
3. *P.Kandasamy, K.Thilagavathy and K. Gunavathy, Engineering Mathematics Vol. I (4th Revised ed.), S.Chand& Co., Publishers, New Delhi (2000).*
4. *John Bird, Higher Engineering Mathematics (5th ed.), Elsevier Ltd, (2006).*

Department of Computer Science and Engineering

Subject Code	Subject Name : **ENGINEERING PHYSICS - I**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BPH18001	Prerequisite : None	Ty	2	0/1	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Outline the relation between Science, Engineering & Technology.
- Demonstrate competency in understanding basic concepts.
- Apply fundamental laws of Physics in Engineering & Technology.
- To identify & solve problems using physics concepts.
- Produce and present activities associated with the course through effective technical communication

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Demonstrate competency in understanding basic concepts. (L1,L2)
CO2	Utilize scientific methods for formal investigations & demonstrate competency with experimental methods and verify the concept to content knowledge. (L1,L2,L3)
CO3	Identify and provide solutions for engineering problems. (L3,L4)
CO4	Relate the technical concepts to day to day life and to practical situations.(L3,L4)
CO5	Think analytically to interpret concepts. (L2,L3,L4)

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	2	2	1		1	2		1
CO2	3	3	2	2	2	2	1		2	2	1	1
CO3	3	3	3	2	2	2	1	1	1	2	1	2
CO4	3	3	2	2	1	2	2	1	2	2	1	2
CO5	3	3	2	1	1	2	1	2	1	2	1	1

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1
CO2	1	3	1	1
CO3	2	3	1	1

Department of Computer Science and Engineering

CO4	2	3	1	1					
CO5	1	3	1	1					
3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low									
Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
	√								

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BPH18001	**ENGINEERING PHYSICS - I**	Ty	2	0/1	0/0	3

UNIT I MECHANICS & PROPERTIES OF MATTER 9Hrs

Mechanics : Introduction- scalar and vector quantities - rigid body - moment of inertia - forces in nature - Newton's laws of motion - derivation of Newton's second law of motion - motion of rocket – dynamical concepts - kinematics - conservation of energy and momentum - conservative and non-conservative forces - mechanics of continuous media - friction and its applications.

Properties of Matter: Elasticity - stress, strain and Hook's law - Poisson's ratio - three moduli of elasticity - twisting couple on a wire - viscosity - flow of liquid through a narrow tube: Poiseuille's law - Ostwald`s viscometer - flow of blood in human body.

UNIT II SHM AND ACOUSTICS 9Hrs

SHM: Simple harmonic motion - differential equation of SHM - graphical representation of SHM - average kinetic energy of vibration - total energy of vibration - free and forced vibrations - damped and undamped vibrations - resonance - transverse wave on a string - law of transverse vibration of string - verification of the laws of transverse vibration of string - standing waves.

Acoustics : Fundamentals of acoustics - reverberation- reverberation time - factors affecting acoustics Ultrasonics - Production of ultrasonic waves - detection of ultrasonic waves - acoustic grating - application of ultrasonic waves.

UNIT IIIWAVE OPTICS 9Hrs

Huygen`s principle - interference of light - wavefront splitting and amplitude - airwedge - Newton`s rings - Michelson interferometer and its applications - Fraunhofer diffraction from a single slit - Rayleigh criterion for limit of resolution - diffraction grating and resolving power of a telescope.

UNIT IV ELECTROMAGNETIC THEORY 9Hrs

Electric field - coulomb`s law - alternating emf - rms and average value of an alternating current & voltage - resistors, capacitors and inductor - energy stored in a capacitor - LCR circuit & resonance – magnetism- definition - types - Biot Savart law - energy stored in a magnetic field - Domain theory - electromagnetic induction - self and mutual inductance - Faraday`s law of electromagnetic induction -Lenz law.

UNIT V LASER 9Hrs

Laser principle and characteristics - amplification of light by population inversion - properties of laser beams: mono-chromaticity, coherence, directionality and brightness - different types of lasers - Ruby laser-Nd-YAG laser-He-Ne laser-CO_2 laser - semiconductor laser - applications of lasers in science, engineering and medicine.

Total Hours : 45

TEXT BOOKS :

1. Brijlal, M. N. Avadhanulu & N. Subrahmanyam, Text Book of Optics, S. Chand Publications, 25th edition, 2012
2. R. Murugeshan, Electricity and Magnetism, S.Chand Publications, 10th edition, 2017
3. R. Murugeshan & Kiruthiga Sivaprasath, Modern Physics, S.Chand Publications, 2016

REFERENCE BOOKS:

1. *Dr. Senthil Kumar Engineering Physics I VRB Publishers, 2016*
2. *N Subrahmanyam & Brijlal, Waves and Oscillations, Vikas Publications, New Delhi,1988*
3. *N Subrahmanyam & Brijlal, Properties of Matter, S. Chand Co., New Delhi, 1982*
4. *N Subrahmanyam & Brijlal, Text book of Optics, S. Chand Co., New Delhi, 1989*
5. *R. Murugeshan, Electricity and Magnetism, S. Chand & Co., New Delhi, 1995*
6. *Thygarajan K & Ajay Ghatak, Laser Theory and Applications, Macmillan, New Delhi, 1981*

7.

Subject Code	Subject Name : **ENGINEERING CHEMISTRY - I**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BCH18001	Prerequisite : None	Ty	2	0/1	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Providing an insight into basic concepts of chemical thermodynamics.
- To create awareness about the water quality parameters, water analysis and softening of water from industrial perspective.
- Imparting fundamentals of emf, storage and fuel cells.
- Creating awareness about corrosion and its control methods.
- Introducing modern materials such as composites along with basic concepts of polymer chemistry and plastics.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Gain a clear understanding of the basic science as applied to engineering problems
CO2	Describe the ideas applied to demonstrate the competence through effective communication
CO3	Recall the information and analyze the health, ethical and engineering problems
CO4	Identify the environmental and societal issues and design solutions
CO5	Apply appropriate techniques by recognizing the need.

Mapping of Course Outcome with Program Outcome (POs)

Department of Computer Science and Engineering

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**										**3**
CO2	**3**	**3**	**2**	**3**						**3**		**2**
CO3	**3**	**2**	**2**		**2**	**3**		**3**				**3**
CO4	**3**			**3**	**3**	**3**	**3**					**3**
CO5	**3**			**3**	**3**							**3**

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1		3		
CO2		3		
CO3		3		
CO4		3		
CO5		3		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
	√								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ETL	L	T/SLr	P/R	C
BCH18001	ENGINEERING CHEMISTRY – I	Ty	2	0/1	0/0	3

UNIT I CHEMICAL THERMODYNAMICS 8Hrs

Introduction, Terminology in thermodynamics –System, Surrounding, State and Path functions, Extensive and intensive properties.Laws of thermodynamics – I and II laws-Need for the II law.Enthalpy, Entropy, Gibbs free energy, Helmholtz free energy - Spontaneity and its criteria.Maxwell relations, Gibbs -Helmholtz equation (relating E & A) and (relating H & G), Van't Hoff equations.

UNIT II TECHNOLOGY OF WATER 9Hrs

Water quality parameters – Definition and expression.Analysis of water – alkalinity, hardness and its determination (EDTA method only). Boiler feed water and Boiler troubles-Scales and sludges, Caustic embrittlement, Priming and Foaming and Boiler corrosion. Water softening processes – Internal and external conditioning – Lime soda, Zeolite, Demineralisation methods.Desalination processes-RO and Electrodialysis .Domestic water treatment.

UNIT III ELECTROCHEMISTRY AND ENERGY STORAGE DEVICES 10Hrs

Conductance – Types of conductance and its Measurement. Electrochemical cells – Electrodes and electrode potential, Nernst equation – EMF measurement and its applications. Types of electrodes- Reference electrodes-Standard hydrogen electrode- Saturated calomel electrode-Quinhydrone electrode –Determination of P^H using these electrodes.Reversible and irreversible cells– Fuel cells- H_2–O_2 fuel cell, Batteries-Lead storage battery,Nickel– Cadmium and Lithium-Battery.

UNIT IV CORROSION AND PROTECTIVE COATING 9Hrs

Introduction–Causes of Corrosion–Consequences- Factors affecting corrosion. Theories of corrosion-Chemical corrosion and Electrochemical corrosion. Methods ofcorrosion control – corrosion inhibitors, Sacrificial anode and Impressed current cathodic protection.Protective coatings- Metallic coatings- Chemical conversion coatings-paints-Constituents and functions.

UNIT V POLYMERS AND COMPOSITES 9Hrs

Monomers – Functionality – Degree of polymerization-Tacticity.Polymers – Classification, Conducting Polymers,Biodegradable polymers- Properties and applications.Plastics – Thermoplastics and thermosetting plastics,Compounding of plastics – Compression moulding, injection moulding and extrusion processes.Polymer composites-introduction-Types of composites-particle reinforced-fiber reinforced-structural composites-examples. Matrix materials, reinforcement materials-Kevlar, Polyamides, fibers, glass, carbon fibers, ceramics and metals .

Total Hours : 45

TEXTBOOKS:

1. S.Nanjundan & C.SreekuttanUnnithan, "Applied Chemistry", Sreelakshmi Publications, (2007)
2. Dr.R.Sivakumar and Dr.N.Sivakumar" Engineering Chemistry" Tata McGraw Hill Publishing Company Ltd, Reprint 2013.

REFERENCE BOOKS:

1. *P.C. Jain & Monika Jain, "Engineering Chemistry", Dhanpat Rai publishing Co., (Ltd.) (2013).*
2. *J. C. Kuriacose & J. Rajaram, "Chemistry in Engineering & Technology", Tata Mc Graw Hill (1996).*
3. *B.R.Puri, L.R.Sharma & M.S.Pathania, "Principles of Physical Chemistry", Vishal publishing co., (2013).*

Department of Computer Science and Engineering

Subject Code	Subject Name : **BASIC ELECTRICAL & ELECTRONICS ENGINEERING**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BES18001	Prerequisite : None	Ty	2	0/1	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Understand the concepts of circuit elements, circuit laws and coupled circuits.
- Gain information on measurement of electrical parameters.
- Acquire knowledge on conventional &non-conventional energy production.
- Identify basic theoretical principles behind the working of modern electronic gadgets.
- Demonstrate digital electronic circuits and assemble simple devices.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Interpret Fundamental principles, laws, and their practical applications (L1,L2)
CO2	Verify the concept of electric & magnetic circuits and interpret results. (L1,L2,L3)
CO3	Analyze various sources of power & energy, generation methods & conservation (L3,L4)
CO4	Identify & Apply schematic symbols and understand the working principles of electronic devices & instruments (L2,L3,L4)
CO5	Design analog & digital circuits using basic concepts to solve problems (L1,L2,L3)

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	3	1	1	1	3	2	1
CO2	3	3	3	3	3	3	3	1	1	2	2	1
CO3	3	3	3	2	3	3	2	1	2	2	3	1
CO4	3	3	3	2	3	2	2	1	3	3	2	1
CO5	3	3	3	2	3	3	2	2	2	2	2	1

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	1
CO2	2	3	2	1
CO3	1	2	1	1
CO4	2	3	2	1
CO5	3	3	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
		√							

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ETL	L	T/SLr	P/R	C
BES18001	**BASIC ELECTRICAL & ELECTRONICS ENGINEERING**	Ty	2	0/1	0/0	3

UNIT I ELECTRIC CIRCUITS 9Hrs

Electrical Quantities – Ohms Law – Kirchhoff's Law – Series and Parallel Connections – Current Division and Voltage Division Rule - Source Transformation – Wye (Y) – Delta (Δ) , Delta (Δ) – Wye (Y) Transformation – Rectangular to Polar and Polar to Rectangular.

UNIT II MACHINES & MEASURING INSTRUMENTS 9Hrs

Construction & Principle of Operation of DC motor & DC Generator – EMF equation of Generator – Torque Equation of Motor – Construction & Principle of operation of a Transformer – PMMC – Moving Iron types of meter – Single Phase Induction Type Energy Meter.

UNIT III BASICS OF POWER SYSTEM 9Hrs

Generation of Electric Power (Thermal, Hydro, Wind and Solar) – Transmission & Distribution of Electric Power – Types of Transmission & Distribution Schemes – Representation of Substation.

UNIT IV ELECTRON DEVICES 9Hrs

Passive Circuit Components-Classification of Semiconductor-PN Junction Diode-Zener diode- Construction and Working Principle –Applications--BJT-Types of configuration-JFET.

UNIT V DIGITAL SYSTEM 9Hrs

Number System – Binary, Decimal, Octal, Hexadecimal – Binary Addition Subtraction, Multiplication & Division– Boolean Algebra – Reduction of Boolean Expressions – Logic Gates - De-Morgan's Theorem , Adder – Subractor.

Total Hours : 45

TEXT BOOKS:

1. D P Kothari, I J Nagrath, Basic Electrical Engineering, Second Edition, , Tata McGraw-Hill Publisher
2. A Course In Electrical And Electronic Measurements And Instrumentation,A.K. Sawhney, publisher DHANPAT RAI&CO
3. Text Book of Electrical Technology: Volume 3: Transmission, Distribution and Utilization,B.L.Theraja, A.K.Theraja, publisher S.CHAND
4. Morris Mano, M. (2002) Digital Logic and Computer Design. Prentice Hall of India
5. Millman and Halkias1991, Electronic Devices and Circuits , Tata McGraw Hill,

REFERENCE BOOK:

1. *R.Muthusubramanian, S.Salivahanan, K A Muraleedharan, Basic Electrical, Electronics And Computer Engineering, Second Edition, ,Tata McGraw-Hill publisher.*

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

Subject Code	Subject Name : **BASIC MECHANICAL & CIVIL ENGINEERING**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BES18002	Prerequisite : None	Ty	2	0/1	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- To understand the fundamentals and applications of IC Engines, power plants, manufacturing processes and mechanics.
- To expose the students to the various construction materials and their applications.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Understand the construction and working principles of steam generators, IC engines and power plants.
CO2	Apply the knowledge of various concepts of Manufacturing processes.
CO3	Solve simple problems on Engineering mechanics
CO4	Identify the appropriate materials and their properties, used for construction purpose
CO5	Apply the knowledge of construction for various structural applications.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	1	2	2	3	3	3		3
CO2	3	2	1	1	1	2	2	2	2	2		2
CO3	3	3	2	1	1	1	2	2	2	2		2
CO4	3	2	2	1	1	1	3	1	2	2		2
CO5	3	2	2	1	1	1	3	2	2	2		2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	-	1	1	-
CO2	-	1	1	1
CO3	-	1	1	-
CO4	-	1	1	1
CO5	-	1	1	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
		√							

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BES18002	BASIC MECHANICAL & CIVIL ENGINEERING	Ty	2	0/1	0/0	3

UNIT I THERMAL ENGINEERING 9 Hrs

Classification of internal combustion engine – two stroke, four stroke petrol and diesel engines.Classification of Boilers – Cochran boiler – Locomotive boilers – Power plant classification – Working of Thermal and Nuclear power plant.

UNIT II MANUFACTURING PROCESS 13 Hrs

Metal forming processes – Rolling, forging, drawing, extrusion and sheet metal operations- fundamentals only. Metal Joining processes – Welding - arc and gas welding, Soldering and Brazing. Casting process – Patterns -Moulding tools - Types of moulding - Preparation of green sand mould -Operation of Cupola furnace.

Basics of metal cutting operations – Working of lathe- parts-Operations performed. Drilling machine – Classification – Radial drilling machine - Twist drill nomenclature.

UNIT III MECHANICS 9 Hrs

Stresses and Strains – Definition – Relationship – Elastic modulus – Centre of gravity – Moment of Inertia – Problems. (Simple Problems Only).

UNIT IV BUILDING MATERIALS AND CONSTRUCTION 7 Hrs

Materials: Brick - Types of Bricks - Test on bricks - Cement – Types, Properties and uses of cement – Steel - Properties and its uses – Ply wood and Plastics.

Construction:Mortar – Ingredients – Uses – Plastering - Types of mortar - Preparation – Uses – Concrete – Types – Grades – Uses – Curing – Introduction to Building Components (foundation to roof) – Masonry – Types of masonry (Bricks & Stones)

UNIT V ROADS, RAILWAYS, BRIDGES & DAMS 7 Hrs

Roads – Classification of roads – Components in roads – Railways -Components of permanent way and their function – Bridges – Components of bridges – Dams – Purpose of dams – Types of dams.

Total Hours : 45

TEXT BOOKS:

1. S. Bhaskar, S. Sellappan, H.N.Sreekanth,, (2002), "*Basic Engineering*" –Hi-Tech Publications
2. K. Venugopal, V. Prabhu Raja, (2013-14), "*Basic Mechanical Engineering*", Anuradha Publications.
3. K.V. Natarajan (2000), *Basic Civil Engineering*,Dhanalakshmi Publishers
4. S.C. Sharma(2002),*Basic Civil Engineering*,Dhanpat Raj Publications

REFERENCE BOOKS:

1. *PR.SL. Somasundaram, (2002), "Basic Mechanical Engineering" –, Vikas Publications.*
2. *S.C. Rangawala(2002), Building Material and Construction, S. Chand Publisher*

Department of Computer Science and Engineering

Subject Code	Subject Name : **BASIC ENGINEERING WORKSHOP**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BES18L01	Prerequisite : None	Lb	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Familiarize the plumbing tools, fittings, carpentry tools, etc.
- Identify basic electrical wiring and measurement of electrical quantities.
- Identify Electronic components, logic gates and soldering process
- Display simple fabrication techniques
- Execute a project independently and make a working model

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Demonstrate fitting tools and carpentry tools, & Perform the process of Filing, Chipping, Cutting.
CO2	Perform the process of fabrication of tray, cones and funnels, Tee Halving Cross, Lap Joint Martise & Joints
CO3	Demonstrate various types of wirings and other equipments.
CO4	Measure fundamental parameters using the electronic instruments

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					2		3	3	3		3
CO2	3	2			1	2		2	2	2		2
CO3	3	3			1	1		3	2	2		2
CO4	3	2			1	1			2	2		2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1		1		
CO2		1		
CO3		1		
CO4		1		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
		√							

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BES18L01	BASIC ENGINEERING WORKSHOP	Lb	0	0/0	2/0	1

MEP PRACTICE

1. **FITTING :**
   Study of fitting tools and Equipments – Practicing, filing, chipping and cutting – making V-joints, half round joint, square cutting and dovetail joints.

2. **CARPENTRY:**
   Introduction – Types of wood – Tools – Carpentry processes – Joints – Planning practice – Tee Halving Joint – Cross Lap Joint – Maritse and Tenon Joint – Dovetail Joint

3. **SHEET METAL:**
   Study of tools and equipments – Fabrication of tray, cones and funnels.

CIVIL ENGINEERING PRACTICE

1. Study of Surveying and its equipments
2. Preparation of plumbing line sketches for water supply and sewage lines
3. Basic pipe connection using valves, laps, couplings, unions, reduces and elbows in house hold fittings

ELECTRICAL ENGINEERING PRACTICE

1. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
2. Measurement of energy using single phase energy meter.
3. Measurement of resistance to earth of an electrical equipment.
4. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
5. Fluorescent lamp wiring.
6. Stair case wiring

ELECTRONIC ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak- peak, rms period, frequency) using CRO
2. Soldering practice – Components Devices and Circuits – Using general purpose PCB

Department of Computer Science and Engineering

Subject Code	Subject Name : **ORIENTATION TO ENTREPRENEURSHIP & PROJECT LAB**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BES18ET1	Prerequisite : None	ETL	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Understand how entrepreneurship Education transforms individuals into successful leaders.
- Identify individual potential &S have career dreams
- Understand difference between ideas & opportunities
- Identify components & create action plan.
- Use brainstorming in a group to generate ideas.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Develop a Business plan & improve ability to recognize business opportunity
CO2	Do a self-analysis to build an entrepreneurial career.
CO3	Articulate an effective elevator pitch.
CO4	Analyze the local market environment & demonstrate the ability to find an attractive market
CO5	Identify the required skills for entrepreneurship & develop

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	2	3	2	2	2		2	2	2	1
CO2	3	2		3	2	3	2	3	3	3	2	2
CO3		2	2	2		3		3	3	3		
CO4		3	2	2	2	2		3	2	2	3	
CO5		2	2	3	2	2	3	3	2	2	3	1

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1
CO2	1	1		
CO3	1	1		
CO4	1	1	1	1
CO5	1	1	1	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills

Department of Computer Science and Engineering

			Science						
								√	

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BES18ET1	ENTREPRENEURSHIP & PROJECT LAB	ETL	0	0/0	2/0	1

UNIT I CHARACTERISTICS OF A SUCCESSFUL ENTREPRENEUR 3Hrs

Introduction to entrepreneurship education – Myths about entrepreneurship – How has entrepreneurship changed the country – Dream it. Do it - Idea planes - Some success stories – Global Legends – Identify your own heroes

UNIT I I ENTREPRENEURIAL STYLE 3Hrs

Entrepreneurial styles – Introduction, concept & Different types - Barrier to Communication – Body language speaks louder than words

UNIT III DESIGN THINKING 3Hrs

Introduction to Design thinking – Myth busters – Design thinking Process - Customer profiling – Wowing your customer – Personal selling – concept & process – show & tell concept – Introduction to the concept of Elevator Pitch

UNIT IV RISK MANAGEMENT 3Hrs

Introduction to risk taking & Resilience – Managing risks (Learning from failures, Myth Buster) – Understanding risks through risk takers – Why do I do? – what do I do ?

UNIT V PROJECT 3Hrs

How to choose a topic – basic skill sets necessary to take up a project – creating a prototype – Pitch your project – Project presentation.

Total : 15 periods

Department of Computer Science and Engineering

SEMESTER II

Subject Code	Subject Name : **MATHEMATICS-II**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BMA18003	Prerequisite : None	Ty	3	1/0	2/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Understand the Basic concepts in Integration
- Identify the Basic concepts in Multiple integrals
- Use the Basic concepts in Ordinary Differential equations
- Apply the Basic concepts of Analytical Geometry
- Analyze the Basic concepts of Vector Calculus

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Demonstrate knowledge of Basic concepts of Mathematics science & Engineering mathematics(L1,L2,L3)
CO2	Calculate the required parameters using basic mathematical theorems, laws and formulae (L1,L2,L3)
CO3	Analyze the problem, find solution & interpret the data (L3,L4)
CO4	Examine the relevant methods, tools and techniques to provide solutions (L1,L3,L4)
CO5	Combine scientific & math principles, apply to real time problems for accurate results (L2,L3,L4)

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	2	2			2	2		3
CO2	3	3	2	1	2	3			3	3		2
CO3	3	3	2	2	2	3	1		3	3		2
CO4	3	3	2	1	1	2		1	2	3	1	2
CO5	3	3	2	2	2	2	1	1	2	3	1	2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1
CO2	2	3	1	
CO3	2	3	1	1
CO4	2	3	1	1
CO5	2	3	1	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
	√								

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BMA18003	MATHEMATICS – II	Ty	3	1/0	2/0	4

UNIT I INTEGRATION 12 Hrs

Basic concepts of Integration – Methods of Integration– Integration by substitution – Integration by parts – Definite integrals– Properties of definite integrals – Problems on finding Area and Volume using single integrals (simple problems).

UNIT II MULTIPLE INTEGRALS 12Hrs Double integral in Cartesian and Polar Co-ordinates – Change of order of integration – Triple integral in Cartesian Co-ordinates – Spherical Polar Co-ordinates – Change of variables (simple problems).

3UNIT III ORDINARY DIFFERENTIAL EQUATIONS 12 Hrs

First order differential equations – Second and higher order linear differential equations with constant coefficients and with RHS of the form: e^{ax}, x^n, Sin ax, Cos ax, $e^{ax}f(x)$, x f(x) where f(x) is Sin bx or Cos bx – Differential equations with variable coefficients (Euler's form) (simple problems).

UNIT IV THREE DIMENSIONAL ANALYTICAL GEOMETRY 12Hrs Direction Cosines and Ratios – Equation of a straight line – Angle between two lines – Equation of a plane – Co-planar lines – Shortest distance between skew lines – Sphere – Tangent plane.

UNIT V VECTOR CALCULUS 12 Hrs

Scalar and Vector functions – Differentiation – Gradient, Divergence and Curl – Directional derivatives – Irrotational and Solenoidal fields– Line, Surface and Volume integrals – Green's, Stoke's and Gauss divergence theorems (statement only) – Verification.

Total Hours : 60

TEXTBOOKS:

1. Kreyszig E., *Advanced Engineering Mathematics (10th ed.)*, John Wiley & Sons, (2011).
2. Veerarajan T., *Engineering Mathematics (for first year)*, Tata McGraw Hill Publishing Co., (2008).

REFERENCE BOOKS:

1. *Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012).*
2. *John Bird, Basic Engineering Mathematics (5th ed.), Elsevier Ltd, (2010).*
3. *P.Kandasamy, K.Thilagavathy and K. Gunavathy, Engineering Mathematics Vol. I (4th Revised ed.), S.Chand& Co., Publishers, New Delhi (2000).*
4. *John Bird, Higher Engineering Mathematics (5th ed.), Elsevier Ltd, (2006).*

Department of Computer Science and Engineering

DEPARTMENT OF PHYSICS

Subject Code	Subject Name : **ENGINEERING PHYSICS - II**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BPH18002	Prerequisite : None	Ty	2	0/1	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Design, conduct experiment and analyze data.
- Develop a Scientific attitude at micro and nano scale of materials
- Understand the concepts of Modern Physics
- Apply the science of materials to Engineering & Technology

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Demonstrate skills necessary for conducting research related to content knowledge and laboratory skills.(L1,L2,L3)
CO2	Apply knowledge and concepts in advanced materials and devices.(L1,L2,L3,L4)
CO3	Acquired Analytical, Mathematical skills for solving engineering problems.(L1,L2,L3)
CO4	Ability to design and conduct experiments as well as function in a multi-disciplinary teams.(L1,L2,L3,L4)
CO5	Generate analytical thought to interpret results & place them within a broader context (L2,L3,L4)

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1			2		1
CO2	3	3	1	2	2	1	1		1	2		1
CO3	3	3	3	3	2	2	2	1		2	1	1
CO4	3	3	3	3	2	2	1	1	3	2	1	1
CO5	3	2	2	2	2	1	1	1	2	2	1	1

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1
CO2	1	3	1	1
CO3	1	3	2	1
CO4	1	1	2	2
CO5	1	2	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic	Engg.Science	Humanities	Program	Program	Open	Practical/Project	Internships/Technical	Soft

Department of Computer Science and Engineering

	Sciences		& social Science	Core	Elective	Elective		Skills	Skills
	√								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BPH18002	ENGINEERING PHYSICS - II	Ty	2	0/1	0/0	3

UNIT I QUANTUM PHYSICS 9 Hrs

Quantum free electron theory - deBroglie waves - derivation of deBroglie waves - Davisson and Germer experiment - uncertainty principle - electron microscope - scanning electron microscope - physical significance of wave function - Schrodinger wave equation and its applications - Fermi energy- effective mass - phonons - Fermi function-density of states - origin of bandgap in solids - 1D scattering of electrons in periodic potential.

UNIT II SEMICONDUCTORS 9 Hrs

Introduction - properties of semiconductors - classification of semiconductor - effect of temperature in semiconductor - hole current - carrier concentration in intrinsic semiconductor (electron and hole density) - variation of Fermi energy level and carrier concentration with temperature in an intrinsic semiconductor - carrier transport - diffusion - drift - mobility - Hall effect - determination of Hall coefficient and its applications - diodes.

UNIT III LIGHT SEMICONDUCTOR INTERACTION 9 Hrs

Types of electronic materials: metals, semiconductors and insulators - qualitative analysis of extrinsic semiconductor & its applications - optical transition in bulk semiconductors: absorption, spontaneous and stimulated emission - exciton and its types - traps and its types - colour centers and its types and importance - luminescence - classifications of luminescence based on excitation - optical loss and gain - Photovoltaic effect - Photovoltaic potential - spectral response - solar energy converters - solar cells.

UNIT IV OPTO ELECTRONIC DEVICES 9 Hrs

Photodetectors - photoconductors - photodiodes principle, construction, working and characteristics - Phototransistors - Laser diodes - LED theory, construction and working - seven segment display, advantages of LED - LCD theory, construction and working.

UNIT V ENGINEERED MATERIALS 9 Hrs

Classification of engineered materials - nano phase materials - its synthesis and properties - shape memory alloys and its applications - biomaterials - non linear materials - metallic glasses - metamaterials - homo and hetero junction semiconductors - semiconducting materials for optoelectronic devices - quantum wells, wires and dots.

Total Hours : 45

TEXT BOOKS:

1. P.K. Palanisamy, Semiconductor Physics and Optoelectronics, Scitech Publications, 2010
2. Jyoti Prasad Bandyopadhyay, Semicoductor Devices, S. Chand Publications, 2014
3. Charles Kittal, Introduction to Solid State Physics, Wiley Publications, 2012

REFERENCE BOOKS:

1. *S. Shubhashree, S. Bharathi Devi & S. Chellammal Madhusudanan, Engineering Physics, Sree Lakshmi Publications, 2004*
2. *G. Senthil Kumar, N. Iyandurai, & G. Vijayakumar, Material Science, VRB Publishers, 2017*
3. *R.Murugeshan & Kiruthigasivaprakash, Modern Physics, 14th edition, S. Chand & Co, 2008*
4. *Pallab Bhattacharya, Semiconductor optoelectronic devices, second edition, Pearson Education, 2003*
5. *V Rajendran & A. Marikani, Materials Science, Tata McGraw- Hill, New Delhi, 2004*

Department of Computer Science and Engineering

DEPARTMENT OF CHEMISTRY

Subject Code	Subject Name : ENGINEERING CHEMISTRY - II	Ty/ Lb/ ETL	L	T/SLr	P/R	C
BCH18002	Prerequisite : None	Ty	2	0/1	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Imparting the basic concepts of phase rule and apply the same to one and two component systems.
- Introducing the chemistry of engineering materials such as cement, lubricants, abrasives, refractories, alloys and nano materials.
- To impart a sound knowledge on the principles of chemistry involving different application-oriented topics
- Introducing salient features of fuels and combustion.
- To give an overview on modern analytical techniques

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Recall, predict the consequences and apply appropriate techniques.(L1,L2,L4)
CO2	Categorize the engineering materials and analytical tools through appropriate communication.(L1,L2,L3,L4)
CO3	Analyze the environmental dimension and identify ethical principles to design solutions .(L1,L2,L3,L4)
CO4	Recognize the essential information for continuing professional development.(L1,L2,L4)
CO5	Apply relevant instrumentation techniques through basic sciences to solve complex problems .(L1,L2,L3,L4)

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**		**3**	**3**								**3**
CO2	**3**	**3**		**3**	**3**		**3**			**3**		**3**
CO3	**3**	**3**	**3**			**3**		**3**				**3**
CO4	**3**						**3**			**3**		**3**
CO5	**3**		**3**		**3**							**2**

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1		3		
CO2		3		
CO3		3		
CO4		3		
CO5		3		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills

	√								

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BCH18002	ENGINEERING CHEMISTRY – II	Ty	2	0/1	0/0	3

UNIT I PHASE EQUILIBRIA 8 Hrs

Introduction – Definition of terms involved in phase rule. Derivation of Gibbs phase rule – Applications to one component system – water system. Binary system – Eutectic system – Pb – Ag system, Bi – Cd system .Thermal analysis – Cooling curves.

UNIT II MATERIAL CHEMISTRY 10 Hrs

Cement – Manufacture, Chemistry of setting and hardening .Lubricants – Requirements of good lubricants, Mechanism, Properties of lubricants, Classification – Examples. Abrasives–Classification –Moh's scale-Hard and soft abrasives, Preparation of artificial abrasives (silicon carbide, boron carbide), Applications of abrasives. Refractories – Classification, Properties-Refractoriness, RUL, Porosity, Thermal spalling Alloys Classification of alloys – Purpose of making alloys - Ferrous and non-Ferrous alloys - Heat treatment Nano materials – properties, carbon nano tubes – properties, fabrication – carbon arc method, laser vapourization method.

UNIT III APPLIED CHEMISTRY 9 Hrs

Soaps and detergents : Soaps – Saponification of oils and fats, manufacture of soaps, classification of soap – soft soap, medicated soap, herbal soap, shaving soap and creams.

Detergents – Anionic detergents – manufacture and applications, Comparison of soaps and detergents.

Rocket propellants and explosives: Rocket propellants – characteristics, solid and liquid propellants – examples. Explosives- Introduction, characteristics, classification, Oxygen balance , preparation, properties and uses of detonators, low explosives and high explosives, Dynamites, Gun cotton, Cordite.

Food adulterants- Common adulterants in different foods – milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses, sweetening agents and beverages, Contamination with toxic chemicals – pesticides and insecticides.

UNIT IV FUELS & COMBUSTION 9 Hrs

Introduction to Fuels – classification – Calorific value – GCV, LCV.Solid Fuels–Coal-Proximate Analysis, Metallurgical Coke–Manufacture of Metallurgical Coke – Liquid Fuel–Refining of Petrol, Synthetic Petrol–Manufacturing Process– Hydrogenation of Coal, Polymerization, Cracking–Knocking–Octane Number–Leaded Petrol (or) Anti–knocking – Cetane Number–Ignition Lag–Gaseous fuels–CNG–LPG–Water Gas, Producer gas–Biogas- Combustion– Flue Gas analysis– Orsat's method.

UNIT V ANALYTICAL AND CHARACTERIZATION TECHNIQUES 9 Hrs

Electron microscopes: Scanning electron microscope & Transmission electron microscope, instrumentation and applications Absorption and Emission Spectrum - Beer - Lambert's law. Visible and UV Spectroscopy – instrumentation – Block diagram - working. IR Spectroscopy – instrumentation - Block diagram – molecular vibrations – stretching and bending – H_2O, CO_2. –Characterization of some important organic functional groups. Chromatographic techniques – column, thin layer and paper.

Total Hours : 45

TEXTBOOKS :

1. C. S.Unnithan, T. Jayachandran& P. Udhayakala, "Industrial Chemistry", Sreelakshmi Publications (2009).
2. Dr.R.Sivakumar and Dr.N.Sivakumar" Engineering Chemistry" Tata McGraw Hill Publishing Company Ltd, Reprint 2013.

REFERENCE BOOKS:

1. *P.C. Jain & Monika Jain, "Engineering Chemistry", DhanpatRai publishing Co., (Ltd.) (2013).*
2. *B. R. Puri ,L.R. Sharma &M.S.Pathania, "Principles of Physical Chemistry", Vishal publishing co., (2013).*

Department of Computer Science and Engineering

Subject Code	Subject Name : **COMMUNICATION LAB**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BEN18ET1	Prerequisite : None	Lb	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Strengthen the academic and interpersonal advanced vocabulary
- Strengthen learners' writing skill such as summarizing, describing and report writing
- Learn to keep the simple conversations in day to day life
- Get to know certain life skills such as marketing, advertising and do presentation
- Improve the reading skill with comprehension

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Use appropriate vocabulary and structure for effective interpersonal and academic communication (L1)
CO2	Interpret charts, diagrams, advertisements, etc. (L2)
CO3	Participate in group discussions and present projects effectively (L3)
CO4	Present project and ideas effectively (L4)
CO5	Attend interviews

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					3					3	3	3
CO2	3	2		3	3		3			3	2	3
CO3	3	3	3	3		3	3		3	3	3	3
CO4	2	3	3	3				3	3	3		3
CO5						2	3	3	3	3	3	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1
CO2	1	3	1	1
CO3	1	3	1	1
CO4	1	3	1	1
CO5	1	3		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
			√						

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BEN18ET1	**COMMUNICATION LAB**	Lb	0	0/0	2/0	1

UNIT I **6HRS**

Listening and Speaking- Informal and Formal Contexts\

UNIT II **6HRS**

Interpretation of charts/ Diagrams – Group Discussion

UNIT III **6HRS**

Compeering –Anchoring – Welcome Speech – Vote of Thanks

UNIT IV **8HRS**

Formal Presentation -Power point presentation – Poster Presentation

UNIT V **4HRS**

Interview

TOTAL HRS:30

SUGGESTED READINGS:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.
(ii) *Remedial English Grammar.* F.T. Wood. Macmillan.2007
(iii)*On Writing Well.*William Zinsser. Harper Resource Book. 2001
(iv) *Study Writing.* Liz Hamp-Lyons and Ben Heasly.Cambridge University Press. 2006.
(v) *Communication Skills*. Sanjay Kumar and Pushp Lata.Oxford University Press. 2011.
(vi) *Exercises in Spoken English.* Parts.I-III. CIEFL, Hyderabad. Oxford University Press
(vi) Pronunciation in Use ,Mark Hancock. Cambridge University Press. 2012

Department of Computer Science and Engineering

Subject Code	Subject Name : **BASIC ENGINEERING GRAPHICS**	**Ty/ Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
BES18ET2	Prerequisite : None	ETL	1	0/0	2/0	2

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- To acquire knowledge in geometrical drawing.
- To expose the students in computer aided drafting**.**

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Gain knowledge on Drawing Standards and angle of projection.
CO2	Draw projections of planes, solid, on planes of projection.
CO3	Apply the knowledge of development to find lateral surface area of solids.
CO4	Visualize and draw Isometric and orthographic projections.
CO5	Apply the knowledge of projection in Building drawing
CO6	Learn and draw simple components using CAD software.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2			3	3	1	3
CO2	3	3	3	3	2	2			3	3	1	3
CO3	3	3	3	1	2	2			2	2	1	2
CO4	3	3	2	2	2	3	1	2	3	3	1	3
CO5	3	3	3	2	3	1	2	2	3	3	1	3
CO6	3	3	3	1	3		2	1	2	2	1	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	1
CO2	1	2	1	1
CO3	1	2	1	1
CO4	1	3	1	1
CO5	1	3	1	1
CO6	1	3	1	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
		√							

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ETL	L	T/SLr	P/R	C
BES18ET2	**BASIC ENGINEERING GRAPHICS**	ETL	1	0/0	2/0	2

CONCEPTS AND CONVENTIONS (Not for examination) **3 Hrs**

Introduction to drawing, importance and areas of applications – BIS standards – IS: 10711 – 2001 : Technical products Documentation – Size and layout of drawing sheets – IS 9606 – 2001: Technical products Documentation – Lettering – IS 10714 & SP 46 – 2003: Dimensioning of Technical Drawings – IS : 15021 – 2001 : Technical drawings – Projections Methods – drawing Instruments, Lettering Practice – Line types and dimensioning – Border lines, lines title blocks Construction of polygons – conic sections – Ellipse, Parabola, Hyperbola and cyloids.

UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES **6 Hrs**

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – projection of polygonal surface and circular lamina in simple position only.

UNIT II PROJECTION OF SOLIDS **6 Hrs**

Projection of simple solids like prism, pyramid, cylinder and cone in simple position Sectioning of above solids in simple vertical position by cutting plane inclined to one reference plane and perpendicular to the other.

UNIT III DEVELOPMMENT OF SURFACES AND ISOMETRIC PROJECTION 6 Hrs

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders, and cones. Principles of isometric projection – isometric scale – isometric projections of simple solids, like prisms pyramids, cylinders and cones.

UNIT IV ORTHOGRAPHICS PROJECTIONS **6 Hrs**

Orthographic projection of simple machine parts – missing views

BUILDING DRAWING

Building components – front, Top and sectional view of a security shed.

UNIT V COMPUTER AIDED DRAFTING **3 Hrs**

Introduction to CAD – Advantages of CAD – Practice of basic commands – Creation of simple components drawing using CAD software.

Total Hours:30

Note:First angle projection to be followed.

TEXT BOOKS:

1. Bhatt, N.D. and Panchal, V.M. (2014) Engineering Drawing Charotar Publishing House
2. Gopalakrishnan, K.R. (2014) Engineering Drawing (Vol.I& II Combined) Subhas Stores, Bangalore.

REFERENCE BOOKS:

1. *Natarajan, K.V (2014) A Text Book of Engineering Graphics, DhanalakshmiPublisheres, Chennai*
2. *Venugopal, K and Prabhu Raja, V. (2010) Engineering Graphics, New Age International (P) Limited*

Special Points applicable to University examinations on Engineering Graphics

1. There will be five questions, each of either or type covering all UNIT-s of the syllabus
2. All questions will carry equal marks of 20 each making a total of 100
3. The answer paper shall consists of drawing sheets of A2 size only. The students will be permitted to use appropriate scale to fit solution within A2 size.

Department of Computer Science and Engineering

Subject Code	Subject Name : **INTEGRATED PHYSICAL SCIENCE LAB**	Ty/ Lb/ ETL	L	T/SLr	P/R	C
BES18L02	Prerequisite : None	Lb	0	0/0	2/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Demonstrate the ability to make physical measurements & understand the limits of precision in measurements.
- Display the ability to measure properties of variety of mechanical, optical, electrical and electronic systems.
- To help learners measure conductivity and EMF using electrical equipment.
- To understand the analytical skills through chromatography & viscometry
- To familiarize the concepts of chem. informatics

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Recognize the correctness and precision in the results of measurements.
CO2	Construct and compare the properties of variety of mechanical, optical, electrical and electronic systems.
CO3	Familiarizing the titration methods using conductometry & potentiometry
CO4	Developing the Research spirit through the knowledge of Chem informatics & Analytical skills.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	1	1		1	2		1
CO2	3	3	2	3	3	2	1		1	2	1	1
CO3	3	3	2	3	3				3			
CO4	3	3	3	3	3		2	2	3		3	2

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1
CO2	1	3	1	1
CO3				
CO4		3		1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
	√								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ETL	L	T/SLr	P/R	C
BES18L02	**INTEGRATED PHYSICAL SCIENCE LAB**	Lb	0	0/0	2/0	1

LIST OF EXPERIMENTS

1. Determination of Coefficient of Viscosity of a given liquid by Poiseuille`s method.
2. Particle Size determination using Laser Source.
3. Determination of Numerical Aperture of an Optical Fiber.
4. Spectrometer- Refractive Index/Dispersive power/i-d curve.
5. Potentiometer - Resistance of a wire.
6. Transistor Characteristics - Input Resistance, Output Resistance and Gain .
7. Studies on acid-base conductometric titration.
8. Determination of redox potentials using potentiometry.
9. Determination of R_f values of various components using thin layer chromatography.
10. Viscosity studies using Digital capillary viscometer.
11. Compute the structures of the given polymers, drugs, biomolecules usingChem Draw.
12. Studies on potential energy surface of the given molecules.
13. Estimate NMR spectra from a Chem Draw structure.

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

Subject Code	Subject Name : **C PROGRAMMING & LAB**	Ty/Lb/ ETL	L	T/SLr	P/R	C
BES18ET3	Prerequisite : None	ETL	1	0/0	2/0	2

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES

- Outline the basics of C Language.
- Apply fundamentals in C programming.
- Produce and present activities associated with the course**.**

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Understand the concepts of C programming
CO2	Develop C Programs using basic programming constructs
CO3	Create Programs with arrays, structures, functions, pointers and file handling
CO4	Write diversified solutions for application using C language

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	1		3	3	1	3
CO2	3	3	3	2	2	2	1		3	3	1	3
CO3	3	3	3	1	1	2	1		2	2	1	2
CO4	3	3	2	2	1	3	1	2	3	3	1	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	2
CO3	3	3	2	2
CO4	3	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, L- Low

Category	Basic Sciences	Engg.Science	Humanities & social Science	Program Core	Program Elective	Open Elective	Practical/Project	Internships/Technical Skills	Soft Skills
							√		

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/	L	T/SLr	P/R	C
BES18ET3	C PROGRAMMING AND LAB	ETL	1	0/0	2/0	2

UNIT I INTRODUCTION **6Hrs**

Fundamentals, C Character set, Identifiers and Keywords, Data Types, Variables and Constants, Structure of a C Program, Executing a C Program.

UNIT II EXPRESSION AND STATEMENT **6 Hrs**

Operators, Types-Complex and Imaginary, Looping Statement-For, While, Do, Break, continue, Decision Statement-If, If else, Nested if, Switching Statement, Conditional Operator.

UNIT III ARRAYS AND FUNCTIONS **6 Hrs**

Defining an Array, Using Array elements as counters, Generate Fibonacci number, Generate Prime Numbers, Initializing Arrays, Multidimensional Arrays, Defining a Function, Function call -types of Function calls -Function pass by value -Function pass by reference, Write a Program in Recursive Function.

UNIT IV STRUCTURES AND POINTERS **6Hrs**Working with Structures -Introduction -Syntax of structures -Declaration and initialization -Declaration of structure variable -Accessing structure variables, Understanding Pointers -Introduction -Syntax of Pointer.

UNIT V STRINGS AND FILE HANDLING **6 Hrs**

Strings -Syntax for declaring a string -Syntax for initializing a string -To read a string from keyboard, Files in C -File handling functions -Opening a File closing a file --example: fopen, fclose -Reading data from a File- Problem solving in C

Total Hours: 30

1. www.spoken-tutorials.org
2. http://www.learn-c.org/

REFERENCE BOOKS :

1. *Stephen G. Kochen" Programming in C- A complete introduction to the C Programming Language. Third Edition, Sams Publishing -2004*
2. *Ajay Mital, " Programming in C: A Practical Approach", Pearson Publication-2010*

LIST OF PROGRAMS

1. Write a program to check 'a' is greater than 'b' or less than 'b' Hint: use if statement.
2. Write another program to check which value is greater 'a', 'b' or 'c'. Hint: use else-if statement. (Take values of a, b, c as user inputs)
3. Write a Program to find the sum of the series : $x + X^3/3! + X^5/5! + \ldots\ldots\ldots\ldots\ldots X^n/n!$
4. Write a C Program to solve a Quadratic Equation by taking input from Keyboard
5. Write a C Program to arrange 20 numbers in ascending and descending Order. Input the Numbers from Keyboard
6. Write a C Program to Multiply a 3 x 3 Matrix with input of members from Keyboard
7. Write a program that takes marks of three students as input. Compare the marks to see which student has scored the highest. Check also if two or more students have scored equal marks.
8. Write a program to display records of an employee. Like name, address, designation, salary.
9. Write a C program, declare a variable and a pointer. Store the address of the variable in the pointer. Print the value of the pointer.
10. Write a C program to concatenate String 'best' and String 'bus'. Hint: strcat(char str1, char str2);
11. Explore the other functions in string library.
12. Write a program to create a file TEST. Write your name and address in the file TEST. Then display it on the console using C program.

Department of Computer Science and Engineering

SEMESTER – III

Subject Code : **BMA18008**	Subject Name : **DISCRETE MATHEMATICS**	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite : None	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- To understand the Basic concepts in Logic and Predicate calculus
- To understand the Basic concepts in Combinatorics
- To understand the Basic concepts in Group theory
- To understand the Basic concepts in Lattices
- To understand the Basic concepts in Graph theory

COURSE OUTCOMES (COs) :
Students completing the course were able to

CO1	Find the summation of the given series logical equations and predicate calculus.
CO2	To determine the functions of permutation and combination.
CO3	To understand the concept of group theory and analysis operation of set operations.
CO4	Apply knowledge and concepts in finding the derivative of given function and to find the maxima / minima of the given function using lattices.
CO5	Evaluate the partial / total differentiation and maxima / minima of a function of several variables.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**			**2**	**2**			**3**	**3**		**3**
CO2	**3**	**3**			**3**	**1**						**3**
CO3	**3**	**3**			**2**				**2**	**3**		**1**
CO4	**3**	**3**			**1**				**2**	**3**		**2**
CO5	**3**	**3**				**2**			**2**	**2**		**3**

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	**2**	**1**	**3**	**1**
CO2	**2**	**1**	**3**	**1**
CO3	**2**	**1**	**3**	**1**
CO4	**2**	**1**	**3**	**1**
CO5	**2**	**1**	**3**	**1**

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
	√								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BMA18008	**DISCRETE MATHEMATICS**	Ty	3	1/0	0/0	4

(Common to II yr. / III Sem. B.Tech (Full Time), I yr. / I Sem. B.Tech (Part Time) - CSE,IT)

UNIT I LOGIC 12 Hrs

Statements – Truth Table – Connectives – Normal Forms – Predicate Calculus – Inference Theory.

UNIT II COMBINATORICS 12 Hrs

Mathematical Induction – Pigeon Hole Principle – Principle of Inclusion and Exclusion – Recurrence Relations – Generating Functions.

UNIT III GROUPS 12 Hrs

Basic Concepts – Groups – Subgroups – Homomorphism – Kernel – Cosets – Lagrange's theorem (simple theorems and problems).

UNIT IV LATTICES 12 Hrs

Partial ordering – Posets – Hasse Diagram – Lattices – Properties of lattices – Sub lattices – Special lattices – Boolean Algebra(Definition & simple problems).

UNIT V GRAPHS 12 Hrs

Introduction to Graphs – Terminology – Matrix representation of Graphs: Incidence matrix, Adjacency matrix – Graph Isomorphism – Connectivity – Euler and Hamiltonian Paths (simple theorems and problems).

Total Hours: 60

TEXT BOOKS:

1. Veerarajan T., *Discrete Mathematics*, Tata McGraw Hill Publishing Co., (2008).
2. Tremblay J.P., Manohar R., *Discrete Mathematical structures with applications to Computer science*, Tata McGraw Hill Publishing Co., (2008).

REFERENCE BOOKS:

1. *Kolman, Busby, Ross, Discrete Mathematical Structures, Pearson, (2014).*
2. *Kenneth Rosen, Discrete Mathematics and its applications (SIE), Tata McGraw Hill Publishing Co., (2007).*

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

Subject Code: **BCS18013**	Subject Name : **DATA STRUCTURES**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Master the implementation of linked data structures such as linked lists and binary trees
- with Be familiar with advanced data structures such as AVL trees and hash tables.
- Be familiar with several sub-quadratic sorting algorithms including quicksort, mergesort and heapsort
- Be familiar some graph algorithms such as shortest path and minimum spanning tree
- Master the standard data structure library of a major programming language(C++)

COURSE OUTCOMES (COs) : (3- 5)

CO1	To understand space and time complexity of various algorithms and implement various operations on arrays and linked list.
CO2	Demonstrate a familiarity with major algorithms and data structures
CO3	To design tree data structure and apply it in data compression algorithms
CO4	Select appropriate searching and/or sorting techniques in the application development
CO5	Implement and analyze graph data structure and apply it to real world problems in finding shortest path.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**
CO1	3	3	3	2	2	1	1	2	1	2	2	2
CO2	3	3	3	2	1	1	3	2	3	2	1	2
CO3	3	2	3	2	3	2	1	2	3	1	2	2
CO4	3	3	3	3	2	2	1	2	3	2	1	2
CO5	3	3	3	2	1	2	1	3	2	1	2	1
	3	3	3	2	2	1	1	2	1	2	2	2

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	1
CO2	3	3	1	2
CO3	3	2	3	1
CO4	3	3	1	2
CO5	3	3	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18013	**DATA STRUCTURES**	Ty	3	0/0	0/0	3

UNIT I **9 Hrs**

Data Representation: Introduction, Linear Lists, Formula Based Representation, indirect addressing, simulating pointers, comparisons and applications. Arrays, matrices, special and sparse matrices,

UNIT II **9 Hrs**

Stack Operations and Applications, Queue Operations and Applications, Single Linked List, Double Linked List, Circular Linked List.

UNIT III **9 Hrs**

Trees: Definitions and Properties, Representation of binary trees and its operations , Binary Tree Traversal, Binary Search Tree, AVL trees and its operations , 2-3 tree, 2-3-4 tree.

UNIT IV **9 Hrs**

Searching & Sorting: Selection Sort, Merge Sort, Quick Sort, Heap Sort, and Radix Sort - Complexity analysis. Sequential Search, Binary Search, Hashing and its Types.

UNIT V **9 Hrs**

Graphs: Definitions and Representation of Graphs, DFS, BFS, Prim's Algorithm, Kruskal's Algorithm

Total Hours: 45

TEXT BOOKS:

1. *S.Sahani,"Data Structures. Algorithms and Applications in C++", Tata Mc-Graw Hill, 2005*
2. *Yedidyah Langsam, MosheJ Augenstein Aaron M. Tenenbaum, "Data Structures using C and C++", Prentice Hall India,1996, Second Edition.*

REFERENCE BOOKS:

1. *Seymour Lipschutz (Schaum"s Outline series). McGraw-Hill – 2005,3rd Edition*
2. *Sartaz Sahani McGraw – HillS.K. Srivatsava, Deepli Srivatsava. BPB Publications.*

Department of Computer Science and Engineering

Subject Code:	Subject Name : IOT Architecture and its Protocol	Ty/ Lb/ ETL	L	T/ S.Lr	P/ R	C
BCS21B01	Prerequisite: -	Ty	3	0/1	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

- To Identify the main components of Internet of Things
- Program the sensors and controller as part of IoT
- Assess different Internet of Things technologies and their applications.
- To learn basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the main components of Internet of Things
CO2	Analyze the sensors and controller as part of IoT
CO3	Evaluate the different Internet of Things technologies and their applications.
CO4	Analyze the basic circuits, sensors and interfacing with real world application
CO5	Understand data conversion process and shield libraries to interface with the real world

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	3	2	2	3	2	2
CO3	3	3	3	3	2	3	2	3	2	3	2	2
CO4	3	3	3	3	3	3	2	2	2	2	2	2
CO5	3	3	3	3	3	3	3	2	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	2	3
CO4	3	3	3	3
CO5	3	3	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills			

				✔								

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21B01	IOT ARCHITECTURES AND ITS PROTOCOLS	Ty	3	0/1	0/0	4

UNIT -I IOT FUNDAMENTALS AND ARCHITECTURE
Definition & Characteristics of IoT - Challenges and Issues - Physical Design of IoT, Logical Design of IoT - IoT Functional Blocks, Security. IoT Reference, Software Design 7 hours Control Units – Communication modules – Bluetooth – Zigbee – Wifi – GPS- IOT Protocols (IPv6, 6LoWPAN, RPL, CoAP etc..), MQTT, Wired Communication, Power Sources

UNIT -II TECHNOLOGIES BEHIND IOT
Four pillars of IOT paradigm, - RFID, Wireless Sensor Networks, SCADA (Supervisory Control and Data Acquisition), M2M - IOT Enabling Technologies - BigData Analytics, Cloud Computing, Embedded Systems.

UNIT -III PROGRAMMING THE MICROCONTROLLER FOR IOT
Working principles of sensors – IOT deployment for Raspberry Pi /Arduino/Equivalent platform Reading from Sensors, Communication: Connecting microcontroller with mobile devices – communication through Bluetooth, wifi and USB - Contiki OS- Cooja Simulator.

UNIT -IV RESOURCE MANAGEMENT IN IOT
Clustering, Clustering for Scalability, Clustering for routing, Clustering Protocols for IOT
From the internet of things to the web of things 9 hours The Future Web of Things – Set up cloud environment – Cloud access from sensors– Data Analytics for IOT- Rest Architectures- The web of Things, Resource Identification and Identifier Richardson Maturity Model

UNIT -V APPLICATIONS OF IOT
Business models for IoT, Green energy buildings and infrastructure, Smart farming, Smart retailing and Smart fleet management, recent trends.

Total Lecture hours: 45 hours

Text Book(s)
1. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri. Internet of Things: Architectures, Protocols and Standards, 1st edition, Wiley Publications, 2019.

2.Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach, 1st edition, University press, 2014.

Reference Books

1. Vermesan, Ovidiu, and Peter Friess, eds. Internet of things-from research and innovation to market deployment, 1st edition, Aalborg: River publishers, 2014.

2.Tsiatsis, Vlasios, Tsiatsis, Vlasios, Stamatis Karnouskos, Jan Holler, David Boyle, and Catherine Mulligan, Internet of Things: technologies and applications for a new age of intelligence, 2nd edition, Academic Press, 2018.

Department of Computer Science and Engineering

Subject Code: BCS18014	Subject Name : COMPUTER ORGANIZATION AND ARCHITECTURE	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BEC18I02	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To understand the major components of a computer including CPU, memory, I/O and storage, understand the uses for cache memory,
- To understand a wide variety of memory technologies both internal and external,
- To understand the role of the operating system in interfacing with the computer hardware

COURSE OUTCOMES (COs) : (3- 5)

CO1	Conceptualize the theoretical basics of central processing unit.(Level 2)
CO2	Illustrate the basic operations of CPU.(Level 3)
CO3	Design a central processing unit. (Level 6)
CO4	Define the concepts of memory organization and I/O processing unit. (Level 1)
CO5	Analyze the execution of simple instruction.(Level 4)

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	2	2	1	2	2	2	1	3
CO2	3	3	3	2	1	1	1	1	2	2	2	3
CO3	3	1	1	1	2	2	1	2	2	2	1	3
CO4	3	3	3	2	1	1	1	1	2	2	2	3
CO5	3	2	3	2	1	1	1	1	2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	1
CO2	3	2	3	2
CO3	3	3	2	2
CO4	2	2	3	2
CO5	2	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18014	COMPUTER ORGANIZATION AND ARCHITECTURE	Ty	3	0/0	0/0	3

UNIT I BASIC STRUCTURE OF COMPUTERS **9 Hrs**

Basic structure of Computer Hardware-Von-Neumann Architecture-Functional units – Bus Structures - Software performance - Memory locations and addresses - Memory operations -Instruction and instruction sequencing

UNIT II ARITHMETIC AND LOGIC UNIT **9 Hrs**

Fixed point arithmetic operation-addition – subtraction – multiplication - division Floating point arithmetic operation-Design of ALU

UNIT III PROCESSOR UNIT **12 Hrs**

Data path implementation-Control unit-hardwired control - micro programmed control, nano programming -Concepts of pipelining - Pipeline hazards

UNIT IV MEMORY SYSTEM **9 Hrs**

Memory hierarchy-Internal organization of RAM – ROM - Interleaved memory-Cache and associative memories -Virtual memory - Memory organization and cache coherence issues

UNIT V INPUT/OUTPUT AND PERIPHERALS **9 Hrs**

Accessing I/O devices – Programmed Input/ Output -Interrupts – Direct Memory Access – IO Processor - Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB) - I/O devices

Total Hours: 45

TEXT BOOKS:

1. *John Hayes (2012) ,(2007)digitized Computer Architecture and Organization, Tata McGraw Hill*

2. *Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.*

REFERENCE BOOKS:

1. *Morris Mano (2009) Computer System Architecture,(3rd ed.),Pearson Education*
2. *John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.*

Department of Computer Science and Engineering

Subject Code: **BEC18I01**	Subject Name : **DIGITAL SYSTEMS**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: BES18001	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To introduce number systems and codes and its conversions
- To introduce Boolean algebra and its applications in digital systems
- To introduce the design of various combinational digital circuits using logic gates
- To bring out the analysis for synchronous and asynchronous Sequential circuits

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquired knowledge about number systems and its conversions
CO2	Acquired knowledge about boolean algebra
CO3	Ability to identify, analyze & design combinational circuits
CO4	Ability to identify & analyze synchronous & asynchronous circuits

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**
CO2	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
CO3	**2**	**2**	**3**	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**1**	**1**
CO4	**2**	**2**	**3**	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**1**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**1**	**3**	**1**	**1**
CO2	**1**	**3**	**1**	**1**
CO3	**3**	**2**	**1**	**1**
CO4	**3**	**2**	**1**	**1**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✔										

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BEC18I01	DIGITAL SYSTEMS	Ty	3	0/0	0/0	3

UNIT I NUMBER SYSTEMS **9 Hrs**

Review of Decimal, Binary, Octal And Hexadecimal Number Systems –Number Conversions – Signed Magnitude form – 1's and 2's Complement - Binary weighted codes- Binary arithmetic – codes – BCD code, Gray code, Excess-3 Code.

UNIT II BOOLEAN ALGEBRA **9 Hrs**

Binary logic Functions- Boolean laws – De Morgan's Theorems, Sum Of Products –Product Of Sums –karnaugh map- Quine McCluskey Method.

UNIT III COMBINATIONAL LOGIC **9 Hrs**

Logic gates – AND, OR, NOT, NOR, NAND and EX-OR Gates– Half adder –Full adder- Half subtractor–Full subtractor - Multiplexer – Demultiplexer- Encoder – Decoder – Code converters - PAL- PLA.

UNIT IV SYNCHRONOUS SEQUENTIAL LOGIC **9 Hrs**

Latches-R-S- Flip Flop, S-R Flip Flop, D Flip Flop, JK Flip Flop, T Flip-Flop - Master slave Flip-Flop - Counters –Up Down counters- Binary counters-Ring counter- Shift Registers.

UNITV ASYNCHRONOUS SEQUENTIAL LOGIC **9 Hrs**

Asynchronous counters –Decade counters - State diagram - State Table – State Reduction – State Assignment- Excitation Table-Analysis of Asynchronous sequential circuits - Design of ASynchronous Sequential Circuits.

Total Hours: 45

TEXT BOOKS:

1. Charles H. Roth & Larry L.Kinney, "Fundamentals of Logic Design", Cengage Learning, 7th Edition.
2. M. Morris Mano & Michael D.Ciletti (2008) Digital Design. Pearson Education
3. Thomas.L.Floyd (2013) "Digital Fundamentals", 10th Edition Pearson Education

REFERENCE BOOKS:

1. *Ronald J. Neal S. Gregory L (2009), "Digital Systems", 10th Edition, Pearson Prentice Hall.*
2. *R P Jain, (2010), "Modern Digital Electronics", 4th Edition, Tata Mcgraw Hill Ed. Pvt. Ltd.*

Department of Computer Science and Engineering

Subject Code: BCS18L01	Subject Name : DATA STRUCTURES LAB	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: NIL	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To strengthen their problem solving ability by applying the characteristics of an object-oriented approach.
- To introduce object oriented concepts in C++ and Java.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Demonstrate the usage of various data structures using simple applications
CO2	Discuss non linear data structure and its application
CO3	Describe the basic operations on arrays, lists, stacks and queue data structures
CO4	Analyze algorithms for operations on Binary Search Trees, AVL data structures.
CO5	Determine and analyze the complexity of given algorithms

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	1	2	1	1	2	2	2	2
CO2	3	3	1	2	1	2	3	1	2	1	3	2
CO3	3	2	1	2	1	2	1	1	2	2	2	2
CO4	3	3	2	2	1	1	3	1	2	1	2	2
CO5	3	3	1	3	2	2	1	1	2	1	2	2
	3	3	1	2	1	2	1	1	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1
CO2	3	1	2	1
CO3	2	2	1	3
CO4	3	2	1	3
CO5	3	2	1	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L01	DATA STRUCTURES LAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS:

1. Operation on arrays – insertion and deletion
2. Linked lists-creation, insertion, deletion of single, double and circular lists.
3. Stack- operations using arrays and linked lists.
4. Infix to postfix conversion
5. Evaluation to postfix expression.
6. Queue- operations using arrays and linked lists.
7. Dequeue, circular-operations
8. Binary tree traversals- In order, pre order, post order using recursion
9. Binary tree traversals- In order, pre order, post order using non recursion
10. Linear and binary search
11. Sorting – Selection Sort, Quick sort, Heap Sort and Merge Sort.
12. Addition, multiplication of sparse matrices
13. Polynomial addition and multiplication
14. Depth first search of a graph
15. Breadth first search of a graph.

Subject Code: BCS21BL1	Subject Name :	Ty/Lb/ ETL	L	T/ S.Lr	P/R

Department of Computer Science and Engineering

	INTERNET OF THINGS LAB-I				
	Prerequisite: NIL	Lb	0	0	3

L:Lecture T:Tutorial S.Lr:Supervised Learning P:Project R:Research C:Credits Ty/Lb/ETL:Theory/Lab/Embedded Theory & Lab

OBJECTIVE :

- Understand the design experiments based on IOT.
- Design the experiments based on IOT with cloud environment

COURSE OUTCOMES (COs) : (3- 5)

CO1	Describe what IoT is and how it works today
CO2	Recognise the factors that contributed to the emergence of IoT
CO3	Design and program IoT devices
CO4	Use real IoT protocols for communication
CO5	Secure the elements of an IoT device

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	3	3	3	3	3	2	2	2	3
CO2	3	3	3	3	3	3	3	2	2	2	3
CO3	3	3	3	3	3	3	3	2	2	2	3
CO4	3	3	3	3	3	3	3	2	2	2	3
CO5	3	3	3	3	3	3	3	2	2	2	3

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2
CO2	2	2	3	3
CO3	3	3	3	2
CO4	3	3	3	2
CO5	2	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✔					

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BL1	**Practical -INTERNET OF THINGS LAB I**	Lb	0	0	3	1

List of Experiments:

1 **FUNCTIONAL TESTING OF DEVICES**

Flashing the OS on to the device into a stable functional state by porting desktop environment with necessary packages.

2 **EXPORTING DISPLAY ON TO OTHER SYSTEMS**

Making use of available laptop/desktop displays as a display for the device using SSH client & X11 display server.

3 **GPIO PROGRAMMING**

Programming of available GPIO pins of the corresponding device using native programming language. Interfacing of I/O devices like LED/Switch etc., and testing the functionality.

4 **INTERFACING CHRONOS EZ430**

Chronos device is a programmable texas instruments watch which can be used for multiple purposes like PPT control, Mouse operations etc., Exploit the features of the device by interfacing with devices.

5 **ON/OFF CONTROL BASED ON LIGHT INTENSITY**

Using the light sensors, monitor the surrounding light intensity & automatically turn ON/OFF the high intensity LED's by taking some pre-defined threshold light intensity value.

6 **BATTERY VOLTAGE RANGE INDICATOR**

Monitor the voltage level of the battery and indicating the same using multiple LED's (for ex: for 3V battery and 3 led's, turn on 3 led's for 2-3V, 2 led's for 1-2V, 1 led for 0.1-1V & turn off all for 0V)

7 **DICE GAME SIMULATION**

Instead of using the conventional dice, generate a random value similar to dice value and display the same using a 16X2 LCD. A possible extension could be to provide the user with option of selecting single or double dice game.

8 **DISPLAYING RSS NEWS FEED ON DISPLAY INTERFACE**

Displaying the RSS news feed headlines on a LCD display connected to device. This can be adapted to other websites like twitter or other information websites. Python can be used to acquire data from the internet.

9 **PORTING OPENWRT TO THE DEVICE**

Attempt to use the device while connecting to a wifi network using a USB dongle and at the same time providing a wireless access point to the dongle.

10 **HOSTING A WEBSITE ON BOARD**

Building and hosting a simple website(static/dynamic) on the device and make it accessible online. There is a need to install server(eg: Apache) and thereby host the

website.

11 **WEBCAM SERVER**

Interfacing the regular usb webcam with the device and turn it into fully functional IP webcam & test the functionality.

12 **FM TRANSMISSION**

Transforming the device into a regular fm transmitter capable of transmitting audio at desired frequency (generally 88-108 Mhz)

Note: Devices mentioned in the above lists include Arduino, Raspbery Pi, Beaglebone

Department of Computer Science and Engineering

Subject Code: BEC18IL1	Subject Name : DIGITAL SYSTEMS LAB	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BES18001	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To introduce number systems and codes and its conversions
- To introduce Boolean algebra and its applications in digital systems
- To introduce the design of various combinational digital circuits using logic gates
- To bring out the analysis for synchronous and asynchronous Sequential circuits

COURSE OUTCOMES (COs) : (3- 5)

CO1	Acquired knowledge about number systems and its conversions
CO2	Acquired knowledge about boolean algebra
CO3	Ability to identify, analyze & design combinational circuits
CO4	Ability to identify & analyze synchronous & asynchronous circuits

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	1	1	1	1	1	2	1	1
CO2	3	2	1	1	1	1	1	1	1	1	1	1
CO3	2	2	3	1	1	2	1	1	2	2	1	1
CO4	2	2	3	1	1	2	1	1	2	2	1	1

COs/ PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	1
CO2	1	3	1	1
CO3	3	2	1	1
CO4	3	2	1	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✔					

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BEC18IL1	DIGITAL SYSTEMS LAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS:

1. Verification of Truth tables of Logic Gates
2. Implementation of Boolean function
3. Implementation of Half and full Adders
4. Implementation of Half and full Subtractors
5. Implementation of Multiplexers
6. Implementation of Demultiplexers
7. Implementation of Encoder
8. Implementation of Decoders
9. Verification of Flip – Flops
10. Implementation of Shift Registers
11. Implementation of Counters
12. Study of A to D Converters

Department of Computer Science and Engineering

Subject Code: **BHS20ET5**	SubjectName: **UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY**	L	T/S.Lr	P/R	C
	Prerequisite:None, UHV1 (Desirable)	2	1/0	0/0	3

L:LectureT :Tutorial SLr: SupervisedLearning P:Project
R:ResearchC:CreditsT/L/ETL:Theory/Lab/Embedded Theoryand Lab

OBJECTIVES:

Human Values Courses: During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

COURSEOUTCOMES(Cos) :(3–5) The students will be ableto

CO1	Relate self and surroundings and identify responsibility in life
CO2	Associate human relationship and nature to handle problems and provide sustainable solutions
CO3	Develop critical ability and engage in reflective and independent Thinking
CO4	Show commitment towards understanding of values
CO5	Apply Human values in day to day setting in real life

Mappingof CourseOutcomeswithProgramOutcomes(POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			**1**	**1**		**2**	**1**		**1**	**1**		**2**
CO2			**2**	**2**	**1**	**2**	**3**	**1**		**2**		**2**
CO3			**1**	**1**	**1**	**2**			**1**	**2**		**3**
CO4			**2**		**1**	**1**	**1**	**3**	**1**	**1**		**3**
CO5			**1**			**2**	**1**	**2**	**1**	**1**		**3**

Cos/PSOs	PSO1	**PSO2**	**PSO3**	**PSO4**
CO1	**1**	**1**	**1**	**1**
CO2	**2**	**2**	**2**	**2**
CO3	**1**	**1**	**1**	**1**
CO4	**1**	**1**	**1**	**2**
CO5	**1**	**2**	**2**	**1**

3/2/1indicatesstrengthofcorrelation3 –High,2–Medium,1– Low

Department of Computer Science and Engineering

Category	BasicSciences	EnggSciences	Humanities &Social Sciences	Program	ProgramElectives	OpenElectives	Practical /Project	Internships /	Soft Skill
			√						

Department of Computer Science and Engineering

BHS20ET5 Universal Human Values 2: Understanding Harmony 2 1/0 0 /03

UNIT I

Introduction - Need, Basic Guidelines, Content and Process for ValueEducation

Purposeandmotivationforthecourse,recapitulationfromUniversal HumanValues-I - Self-Exploration– what is it? -Its content and process; 'Natural Acceptance'andExperientialValidation-astheprocessforself-exploration. – ContinuousHappinessandProsperity-AlookatbasicHuman Aspirations - Right understanding, Relationship and Physical Facility- the basic requirementsforfulfilmentofaspirationsofeveryhumanbeingwiththeir correct priority-UnderstandingHappinessandProsperitycorrectly-Acriticalappraisalof the currentscenario– Methodtofulfiltheabovehumanaspirations:understandingandliving in harmony atvariouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance forliving with responsibility (living in relationship, harmony and co-existence) rather than asarbitrariness in choice based on liking-disliking.

UNIT II

Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. - Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). - Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physicalneeds, meaning of Prosperity in detail - Programs to ensureSanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available tome. Identifying from one's own life.

Differentiate between prosperity and accumulation. Discussprogram for ensuring health vs dealing with disease

UNIT III

Understanding Harmony in the Family and Society- Harmony in Human-HumanRelationship

Understanding values in human-human relationship; meaning of Justice (nine universal values inrelationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect asthe foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the othersalient values in relationship - Understanding the harmony in the society (society being an extension of family): Resolution,Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- fromfamily to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family,real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal valuein relationship. Discuss with scenarios. Elicit examples from students' lives.

UNIT IV

Understanding Harmony in the Nature and Existence - Whole existence asCoexistence

Understanding the harmony in the Nature - Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulationin nature - Understanding Existence as Co-existence of mutually interacting units in all-pervasive space - Holistic perception of harmony at all levels of existence - Include practice sessions to discuss human being as cause of imbalance in nature (film

"Home" canbe used), pollution, depletion of resources and role of technology etc.

UNIT V

Implications of the above Holistic Understanding of Harmony on ProfessionalEthics

Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: a. Ability to utilize the professional competence foraugmenting universal human order b. Ability to identify the scope and characteristics of peoplefriendlyand eco-friendly production systems, c. Ability to identify and develop appropriatetechnologies and management patterns for above production systems. - Case studies of typical holistic technologies, management models and production systems - Strategy for transition from the present state to Universal Human Order: ((a) At the level ofindividual: as socially and ecologically responsible engineers, technologists and managers, (b)Atthe level of society: as mutually enriching institutions and organizations - Sum up

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g.To discuss the conduct as an engineer or scientist etc.

Text Book

1. *Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010*

Reference Books

1. *Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.*
2. *Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.*
3. *The Story of Stuff (Book).*
4. *The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.*
5. *Small is Beautiful - E. F Schumacher.*
6. *Slow is Beautiful - Cecile Andrews*
7. *Economy of Permanence - J C Kumarappa*
8. *Bharat Mein Angreji Raj - PanditSunderlal*
9. *Rediscovering India - by Dharampal*
10. *Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi*
11. *India Wins Freedom - Maulana Abdul Kalam Azad*
12. *Vivekananda - Romain Rolland (English)*
13. *Gandhi - Romain Rolland (English)*

Department of Computer Science and Engineering

SEMESTER – IV

Subject Code : **BMA18016**	Subject Name : **STATISTICS FOR COMPUTER ENGINEERS**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite : None	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- To understand the Basic concepts in Statistics
- To understand the Basic concepts in Probability
- To understand the Basic concepts in Correlation
- To understand the Basic concepts in Probability distributions
- To understand the Basic concepts in Sampling theory

COURSE OUTCOMES (COs) :

Students completing the course were able to

CO1	Find the summation of the given series.
CO2	To determine the functions of permutation and combination.
CO3	To understand the concept of corelation operations.
CO4	Apply knowledge and concepts in finding the derivative of given function and to find the maxima / minima o the given function using lattices.
CO5	Evaluate the partial / total differentiation and maxima / minima of a function of several variables.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**			**2**	**2**			**3**	**3**		**3**
CO2	**3**	**3**			**3**	**1**						**3**
CO3	**3**	**3**			**2**				**2**	**3**		**1**
CO4	**3**	**3**			**1**				**2**	**3**		**2**
CO5	**3**	**3**				**2**			**2**	**2**		**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**1**	**3**	**1**
CO2	**2**	**1**	**3**	**1**
CO3	**2**	**1**	**3**	**1**
CO4	**2**	**1**	**3**	**1**
CO5	**2**	**1**	**3**	**1**

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
	√								

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BMA18016	STATISTICS FOR COMPUTER ENGINEERS	Ty	3	1/0	0/0	4

(Common to III yr. / V Sem. B.Tech (Full Time), I yr. / II Sem. B.Tech (Part Time) – CSE,IT)

UNIT I BASICS OF STATISTICS (12 hrs)

Variables – Uni-variate Data – Frequency Distribution – Measures of Central Tendency – Mean –Median –Mode – Quartiles – Measures of Dispersion – The Range – Quartile Deviation –Standard Deviation – Relative Measures of Dispersion – Coefficient of Variation – Quartile Coefficient of Variation.

UNIT II PROBABILITY AND RANDOM VARIABLE (12 hrs)

Axioms of Probability – Conditional probability – Total probability – Baye's Theorem – Random variable – Probability mass function – Probability density function – Properties – Moments (Definition and simple problems).

UNIT III CORRELATION & REGRESSION (12 hrs)

Measures of Skewness & Kurtosis – Bi-variate data – Applications of Correlation: Karl Pearson's Coefficient of Correlation – Rank Correlation: Spearman's Rank Correlation – Linear Regression.

UNIT IV STANDARD DISTRIBUTIONS (12 hrs)

Binomial – Poisson – Geometric –Uniform – Exponential –Normal distributions.

UNIT V TESTING OF HYPOTHESIS (12 hrs)

Tests of Significance – Large Sample Tests – Mean – Proportions – Small Sample Tests – t, F, Chi-square Tests: Independence of Attributes, Goodness of Fit.

Total no. of hrs: 60

TEXT BOOKS:

1. Veerarajan T., *Probability, Statistics and, Random Processes*, Tata McGraw Hill Publishing Co., (2008).
2. Gupta S.C., Kapoor V.K., *Fundamentals of Mathematical Statistics*, S.Chand & Co., (2007).

REFERENCE BOOKS:

1. Singaravelu, *Probability and Random Processes*, Meenakshi Agency, (2017).

2. Richard Johnson A., *Miller & Freund's Probability and statistics for Engineers (9th ed)*, Prentice Hall of India, (2016).

Department of Computer Science and Engineering

Subject Code: BCS18015	Subject Name : DATABASE MANAGEMENT SYSTEMS	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BCS18001	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
- To develop an understanding of essential DBMS concepts such as: database security, integrity, and concurrency.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the fundamental concepts and techniques of DBMS
CO2	Analyze routine requisite for edifice, maintain, and querying databases.
CO3	Represent diverse indexing approach in different database systems
CO4	Evaluate a directory on base of adequate scheme.
CO5	Design an application by means of PL/SQL.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	1	2	2	2	2	2
CO2	3	2	3	2	2	3	2	2	2	2	1	3
CO3	2	3	3	3	3	3	3	1	3	3	3	3
CO4	3	3	3	3	3	2	2	2	3	3	3	3
CO5	2	3	3	2	3	2	2	1	3	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	3	3	3
CO3	2	3	3	3
CO4	2	3	3	3
CO5	2	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18015	DATABASE MANAGEMENT SYSTEMS	Ty	3	0/0	0/0	3

UNIT I FUNDAMENTALS OF DATABASE **9 Hrs**

Introduction - Purpose of database systems – Data Abstraction -Data models – Instances and schemas – Data Independence – DDL – DML – Database user – ER model – Entity sets- keys – ER diagram – relational model – structure – relational algebra- relational calculus- views

UNIT II SQL **9 Hrs**

SQL - QBE - level – Basic Structure – various operations – relational database design – problems in the relational database design – normalization – normalization using functional – Multivalued join dependence

UNIT III FILE STRUCTURE, INDEXING & HASHING **9 Hrs**

File and system structure – overall system structure – file transaction – data dictionary – indexing and hashing basic concepts and B+ tree Indices - static and dynamic hash functions

UNIT IVQUERY PROCESSING AND TRANSACTIONS **9 Hrs**

Overview - Measures of Query Cost - Selection Operation – Sorting - Join Operation- Transaction Concept - A Simple Transaction Model - Storage Structure – Serializability

UNIT V CONCURRENCY CONTROL AND RECOVERY SYSTEM **9 Hrs**

Lock-Based Protocols - Deadlock Handling - Timestamp-Based Protocols - Validation-Based Protocols - Failures Classification – Storage - Recovery and Atomicity - Recovery Algorithm - Buffer Management

Total Hours: 45

TEXT BOOKS:

1. Abraham, Silberschatz. Henry, F. K.. Sudharshan, S. (2013) Database System Concepts (6thed.) Tata McGraw Hill, New Delhi

REFERENCE BOOKS:

1. *Ramez, E. Shamkant, B. Navathe (2008) Fundamentals of database systems (5th ed.), Pearson Education*
2. *Date, C. J, (2012) An Introduction to Database Systems (8th ed.), Pearson Education*

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

Subject Code: BEC18I02	Subject Name : MICROPROCESSORS AND MICROCONTROLLERS	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BEC18I01	TY	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study the basic architectures and operational features of the processors and controllers.
- To learn the assembly language and programming of 8086.
- To design and understand the multiprocessor configuration.
- To understand the interfacing concepts of the peripheral devices with processors.

COURSE OUTCOMES (COs) : (3- 5)
Upon the completion of the course students will be able to

CO1	Describe the working of 8086 Microprocessor
CO2	Demonstrate the programming in microprocessor
CO3	Analyze the interfacing of different peripheral devices with the microprocessors
CO4	Explain the operation of 8051 microcontroller in real time process
CO5	Illustrate the applications of 8051

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	2	1	1	2	1	2	2	2
CO2	3	3	3	3	2	1	2	2	2	2	2	2
CO3	2	3	3	3	3	2	2	2	1	3	2	2
CO4	3	3	3	3	3	1	2	2	2	2	2	3
CO5	3	3	3	3	3	1	2	2	1	1	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1
CO2	2	3	3	1
CO3	3	3	3	2
CO4	3	3	3	1
CO5	2	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

		✔										

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BEC18I02	MICROPROCESSORS AND MICROCONTROLLERS	Ty	3	0/0	0/0	3

UNIT I 16 BIT MICROPROCESSOR 9 Hrs

Evolution of processors – 8086 Architecture – Functional Diagram – Register organization – Memory Addresses – Minimum mode – Maximum mode – Interrupts of 8086

UNIT II INSTRUCTION SET AND ALP 9 Hrs

Instruction Formats – Addressing modes – Instruction set – Simple programs involving logical, branch and call instructions – sorting – string manipulations

UNIT III INTERFACING 9 Hrs

Memory Interfacing – I/O Interfacing – Programmable Peripheral Interface 8255 – USART – DMA controller – Programmable Interval Timer 8253

UNIT IV MICROCONTROLLER 9 Hrs

Introduction – 8051 Architecture – I/O Ports – Memory Organization – Addressing modes – Interrupts

UNIT V APPLICATIONS 9 Hrs

Instruction set of 8051 – Applications – Simple programs – Interfacing with ADC- Interfacing with DAC- Stepper Motor – Traffic Light Controller

Total Hours: 45

TEXT BOOKS:

1. Ray A.K. & Bhurchandi K.M. (2013) Advanced Microprocessors and Peripherals, Tata McGraw Hill Education pvt Ltd
2. Douglas v Hall. (2006) Microprocessors and Interfacing (2nd ed.), Tata McGraw Hill Publishing company Limited

REFERENCE BOOKS:

1. *Badri Ram. (2006) Advanced Microprocessors and Interfacing, Tata McGraaw Hill Publishing company limited*
2. *Kenneth J. Ayala (2008) "The 8051 Micro Controller", 3rd Edition, Thomas Delmar Learning.*

Department of Computer Science and Engineering

Subject Code: BCS21B02	Subject Name : Sensors and Actuator Devices for IOT	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BEC18I01	TY	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study the IoT networking components.
- To build schematic for IoT solutions
- To design and understand the IoT basedsensor systems
- To understand the wireless sensor technologiesfor IoT

COURSE OUTCOMES (COs) : (3- 5)
Upon the completion of the course students will be able to

CO1	Identify the IoT networking components with respect to sensors.
CO2	Build schematic for IoT solutions with sensors.
CO3	Design and develop IoT based sensor systems.
CO4	Select the appropriate sensors for various industrial applications
CO5	Evaluate the wireless sensor technologies for IoT.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	2	3	2	2
CO2	3	3	3	3	3	3	2	3	3	2	2	2
CO3	3	3	3	3	2	3	2	3	2	1	1	2
CO4	3	3	3	3	3	2	3	2	2	2	2	2
CO5	3	3	3	3	2	2	2	2	2	1	2	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	2
CO3	3	3	3	2
CO4	3	3	2	3
CO5	3	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✔										

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21B02	SENSORS AND ACTUATOR DEVICES	Ty	2	0/0	0/0	NC

UNIT- I INTRODUCTION TO SENSORS AND ACTUATOR FOR IOT

Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device Introduction to Sensors and Actuator- Sensor and Actuator Characteristics- Primary factors driving the deployment of sensor technology

UNIT- II SEVEN GENERATIONS OF IOT SENSORS

Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap

UNIT- III ENERGY HARVESTING TECHNOLOGIES

Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module– Sensing Module

UNIT- IV SENSORS FOR AUTOMOTIVE VEHICLE AND SECURITY APPLICATIONS

Tyre pressure monitoring systems - Two wheeler and Four wheeler security systems - Parking guide systems - Anti-lock braking system - Future safety technologies- Vehicle diagnostics and health monitoring Sensor and Actuators in smart cities Sensors in Home activity monitoring, human activity recognition, road traffic management,

UNIT- V DEVELOPING AN IOT BASED APPLICATIONS

Smart Energy Monitor Based on IoT, Develop a Face Recognizing Robot, Build an IoT based Smart Home System, IoT Based Air Quality Index Monitoring, IoT Based Contactless Body Temperature Monitor. Recent Trends.

Total Lecture hours: 45 hours

Text Book(s)

1. Timothy Chou,. Precision: Principles, Practices and Solutions for the Internet of Things, Cloudbook Inc., USA. April-13 2020

2.Maggie Lin and Qiang Lin., Internet of Things Ecosystem: 2nd Edition,. January 19, 2021., independently published

Reference Books

1. Patranabis, Sensors and Actuators, 2nd edition, PHI, 2013 D. Patranabis, Sensors and Transducers, 1st edition, PHI Learning Private Limited,2013 Monk, Simon.
2. Programming the Raspberry Pi: getting started with Python, 1st edition, McGraw-Hill Education, 2016.

Department of Computer Science and Engineering

Subject Code: **BHS18NC1**	Subject Name **THEINDIAN CONSTITUTION**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	**Ty**	**2**	**0/0**	**0/0**	**NC**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To provideanoverview of thehistoryofthemakingofIndianConstitution
- To understandthepreambleandthebasic structures oftheConstitution.
- To Know the fundamentalrights, dutiesandthedirectiveprinciplesof state policy
- To understand the functionality of the legislature ,theexecutiveand thejudiciary

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	To provideanoverview of thehistoryofthemakingofIndianConstitution
CO2	To understandthepreambleandthebasic structures oftheConstitution.
CO3	To Know the fundamentalrights, dutiesandthedirectiveprinciplesof state policy

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1						**3**	**1**	**1**	**1**	**1**		
CO2						**3**	**1**	**1**	**1**	**1**		
CO3						**3**	**1**	**1**	**2**			

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO 4**
CO1	**1**	**1**	**2**	**3**
CO2	**1**	**1**	**2**	**2**
CO3	**1**	**1**	**2**	**1**

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities &Social Sciences	Program core	Program Electives	Open Electives	Practical/ Project	Internships / Technical Skills	Soft Skills			
			✓									

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BHS18NC1	THEINDIAN CONSTITUTION	Ty	2	0/0	0/0	NC

UNIT I **3Hrs**

The HistoryoftheMakingof IndianConstitution, Preamble andthe BasicStructures

UNIT II **3Hrs**

FundamentalRightsand Duties , Directive Principlesof State Policy

UNIT III **3Hrs**

Legislature, Executive and Judiciary

UNIT IV **3Hrs**

EmergencyPowers

UNIT V **3Hrs**

Special Provisions for Jammu andKashmir, Nagalandand OtherRegions, Amendments

Total Hours: 15

TEXT BOOKS:

1. D D Basu, Introductiontothe Constitutionof India,20th Edn.,LexisnexisButterworths, 2012.

REFERENCE BOOKS:

1. *Rajeev Bhargava (ed), Ethics and Politics of the Indian Constitution, Oxford University Press, NewDelhi, 2008.*
2. *GranvilleAustin,TheIndianConstitution:CornerstoneofaNation,OxfordUniversityPress, Oxford, 1966.*
3. *Zoya Hassan, E. Sridharan andR. Sudarshan (eds), India's Living Constitution: Ideas, Practices, Controversies,Permanent Black, NewDelhi, 2002.*
4. *SubhashC.Kashyap,OurConstitution,National BookTrust, NewDelhi, 2011.*

Department of Computer Science and Engineering

Subject Code: **BHS18NC2**	Subject Name : **THE INDIAN TRADITIONAL KNOWLEDGE**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	Ty	2	0/0	0/0	NC

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
- To understandtheTraditional Medicine, Traditional Production and Construction Technology
- To Know the History of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronomy and Astrology
- To understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India
-

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	To understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
CO2	To understandtheTraditional Medicine, Traditional Production and Construction Technology
CO3	To understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		**3**	**3**	**1**		**2**				**2**		**1**
CO2		**3**	**3**	**1**		**2**				**2**		**1**
CO3		**3**	**3**	**1**		**2**				**2**		**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**			
CO1	**1**	**1**	**2**	**2**			
CO2	**1**	**1**	**2**	**1**			
CO3	**1**	**1**	**2**	**3**			

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engg Sciences	Humanities &Social Sciences	Program core	Program Electives	Open Electives	Practical/ Project	Internships / Technical	Soft Skills			
			✓									

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BHS18NC2	THEINDIAN TRADITIONAL KNOWLEDGE	Ty	2	0/0	0/0	NC

UNIT I **3Hrs**

Historical Background: TKS During the Pre- colonial and Colonial Period, Indian Traditional Knowledge System

UNIT II **3Hrs**

Traditional Medicine, Traditional Production and Construction Technology

UNIT III **3Hrs**

History of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronomy and Astrology

UNIT IV **3Hrs**

Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

UNIT V **3Hrs**

TKS and the Contemporary World, TKS and the Indian Union, TKS and IT Revolution

Total Hours: 15

TEXT BOOKS:

1. Amit Jha (2009) , Traditional knowledge system in india, 1st Edition, Delhi University (North Campus)
2. Dr.A.K.Ghosh (2011), Traditional Knowledge of Household Products

Department of Computer Science and Engineering

Subject Code: **BCS18ET1**	Subject Name : **JAVA PROGRAMMING**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: BCS18002	ETL	1	0/1	3/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : To teach the basic concepts and techniques which form the object oriented programming paradigm.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
CO2	Demonstrate the concepts of polymorphism and inheritance.
CO3	Explain the principles of packages and interfaces.
CO4	Create client Side Programming Using Java Applet.
CO5	Develop own application project/ Mini Project using java programming.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**1**	**1**	**1**	**3**	**2**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**2**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
	3	**3**	**3**	**3**	**1**	**3**	**3**	**1**	**1**	**1**	**3**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**2**	**1**	**2**	**2**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

					✔							

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18ET1	JAVA PROGRAMMING	ETL	1	0/1	3/0	3

UNITI OVERVIEW OF JAVA LANGUAGE 9 Hrs

Introduction to Java,Features of Java,Comparison with C and C++, Java and World Wide Web, Java Environment, Java Development kit (JDK),Java Runtime Environment(JRE), Application Programming Interface (API), Java Virtual Machine (JVM),Primitive Datatypes, Declarations, Ranges,Variable Names Conventions,Numeric Literals, Character Literals,String Literals,Arrays(One dimensional, two- dimensional), Enumerated Data Types

UNITII CLASSES, OBJECTS AND METHODS: 9 Hrs

Classes and Objects,Defining a class;Defining instance variables and methods,Creating objects out of a class,Method calls via object references,Abstraction,Packages,Interfaces and Abstract classes,Abstract and non-abstract methods,Inheritance,extends and implements keywords in Java,Super class and Sub class,this keyword, super keyword in Java for inheritance,Concrete classes in Java,Polymorphism,Compile time polymorphism - Overloading of methods,Run time polymorphism - Overriding of methods,Method Overriding rules and method overloading rules,Encapsulation.

UNITIII EXCEPTION AND MULTITHREADED PROGRAMMING 9 Hrs

Exception handling, Need for exceptions, API heirarchy for Exceptions, Types of Exceptions, Keywords in Exception API: try, catch, finally, throw, throws, -Introduction to Threads – Creating Threads, Extending the Thread Class, Implementing the runnable interface, life cycle of a thread, priority of a thread, Multithreading ,Synchronization, Dead Lock.

UNITIV STREAMS AND OBJECT SERIALIZATION 9 Hrs

Overview of Streams,Bytes vs. Characters,Overview of the entire Java IO API,Reading a file; writing to a file usinf various APIs,Reading User input from console, PrintWriter Class, Object Serialization, Serializable Interface, Serialization API, ObjectInputStream and ObjectOutput, Transient Fields, readObject and writeObject.

UNITV GRAPHICS PROGRAMMING: 9 Hrs

Introduction, Abstract Window Toolkit (AWT),Applets-Life Cycle- Basics of event handling – event handlers – adapter classes – actions – mouse events –AWT event hierarchy – introduction to Swing – buttons–Layout Management–Swing Components.

Total Hours: 45

TEXT BOOKS:

1. Herbert Schildt, “The Complete Reference JAVA 2”, Tata McGraw Hill publications, 7th Ed., 2007.
2. Balagurusamy, “Programming with JAVA A primer 3rd Edition”, Tata McGraw-Hill, 2007

REFERENCE BOOKS:

1. Y.Daniel Liang, “An Introduction to JAVA Programming”, Pearson, 2015
2. Kathy Sierra, Bert Bates,“ Head First Java”, Oreilly Publication, 2nd Edition, 2005

Department of Computer Science and Engineering

Subject Code: BCS18L03	Subject Name : DATABASE MANAGEMENT SYSTEMS LAB	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BCS18L01	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To create a database and query it using SQL, design forms and generate reports.
- Understand the significance of integrity constraints, referential integrity constraints, triggers, assertions.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the programming and theoretical concept of commands.
CO2	Analyze the problem and apply the syntactical structure of query.
CO3	Remember the structure and syntax of PL/SQL.
CO4	Understand the problem and apply the programming knowledge for determining solutions.
CO5	Will be able to Design a database by applying the knowledge.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	1	3	3	2	2	2	2	1	2
CO2	3	3	3	2	3	2	1	1	3	3	2	2
CO3	2	2	3	2	2	3	1	1	3	2	2	3
CO4	3	3	3	3	3	3	2	1	3	2	3	2
CO5	3	3	2	2	3	3	2	2	3	1	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3
CO2	3	3	3	3
CO3	2	3	3	2
CO4	2	3	3	2
CO5	2	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

							✔					

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L03	DATABASE MANAGEMENT SYSTEMS LAB	Lb	0	0/0	3/0	1

I. Program to learn DDL and DML commands

1. Execution of data descrption language commands
2. Execution of data manupulation language commands
3. Execution of data control language commands
4. Execution of transation control language commands
5. Insert command
6. Select, from and where clause
7. Set operation [union, intersection, except]
8. String operations
9. Nested queries
10. Join operation
11. Modification of the database

II. PL / SQL programs

1. Control statements (for loop)
2. Control statements (while loop)
3. Control statements (for reverse loop)
4. Control statements (loop end loop)
5. Sum of even numbers
6. Sum of odd numbers
7. Series generation
8. Implementation of sub-program
9. Implementation of cursor using pl/sql
10. Control statement (if-else end if)

Department of Computer Science and Engineering

Subject Code: **BCS21BL2**	Subject Name : **Practical -INTERNET OF THINGS LAB II**	**Ty/Lb/ ETE**	**L**	**T/ S.Lr**	**P / R**	**C**
	Prerequisite: NIL	Lb	0	0	3	1

L:Lecture T:Tutorial S.Lr:Supervised Learning P:Project R:Research C:Credits Ty/Lb/ETL:Theory/Lab/Embedded Theory & Lab

OBJECTIVE :

- To acquire knowledge about on sensor with IOT.
- To design experiments based on IOT with cloud environment.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Use microprocessor based embedded platforms in IOT
CO2	Use wireless peripherals for exchange of data.
CO3	Make use of Cloud platform to upload and analyse any sensor data
CO4	Use of Devices, Gateways and Data Management in IoT.
CO5	Use the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	3	3	3	3	3	2	2	2	3
CO2	3	3	3	3	3	3	3	2	2	2	3
CO3	3	3	3	3	3	3	3	2	2	2	3
CO4	3	3	3	3	3	3	3	2	2	2	3
CO5	3	3	3	3	3	3	3	2	2	2	3

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2
CO2	2	2	3	3
CO3	3	3	3	2
CO4	3	3	3	2

Department of Computer Science and Engineering

CO5	2	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills		
							✔				

BCS21BL2	**Practical -INTERNET OF THINGS LAB II**	Lb	0	0	3	1

List of Experiments:

1. Introduction to Arduino platform and programming
2. Interfacing Arduino to Zigbee module
3. Interfacing Arduino to GSM module
4. Interfacing Arduino to Bluetooth Module
5. Introduction to Raspberry PI platform and python programming
6. Interfacing sensors to Raspberry PI
7. Communicate between Arduino and Raspberry PI using any wireless medium

8	Setup a cloud platform to log the data
9	Log Data using Raspberry PI and upload to the cloud platform
10	Design an IOT based system

Department of Computer Science and Engineering

Subject Code: BEC18IL2	Subject Name : MICROPROCESSORS AND MICROCONTROLLERS LAB	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BEC18IL1	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the assembly language programming of 8086.
- To learn the assembly language programming of 8051.
- To understand the interfacing concepts of the peripheral devices with processors

COURSE OUTCOMES (COs) : (3- 5)

CO1	Ability to understand the Programming of 8086 microprocessor
CO2	Ability to understand the Programming of 8051 microcontroller
CO3	Understand the applications of microprocessors & microcontrollers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	1	1	1	1	1	2
CO2	3	2	1	1	2	1	1	1	1	1	1	2
CO3	3	2	1	1	2	1	1	1	1	1	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1
CO2	3	2	1	1
CO3	3	2	1	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✔					

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BEC18IL2	MICROPROCESSORS AND MICROCONTROLLERS LAB	Lb	0	0/0	3/0	1

8086 Microprocessor:

1. Arithmetic operations
2. Block Movement of Data
3. Square and square root
4. Searching and sorting

8051 Microcontroller:

1. Arithmetic operations
2. Block Movement of Data
3. Square and square root
4. Searching and sorting

Interfacing:

1. Traffic light Controller
2. Stepper Motor Controller
3. Waveform Generation
4. Matrix Display

Department of Computer Science and Engineering

Subject Code: BCS18TS1	Subject Name : TECHNICAL SKILL I (EVALUATION)	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To make the students expert in domain specific knowledge.
- To develop professionals with idealistic, practical and moral values.
- To facilitate the students with emerging technology

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the domain specific knowledge.
CO2	Able to apply idealistic, practical and moral values.
CO3	Familiarize with emerging technology

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	2	2	1	1	1	3	1
CO2	3	3	2	3	3	2	2	2	2	2	3	1
CO3	3	3	3	3	3	2	2	1	2	2	3	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1
CO2	3	3	1	3
CO3	3	3	1	3

3/2/1indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
								✔	

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18TS1	**TECHNICAL SKILL I (EVALUATION)**	Lb	0	0/0	3/0	1

OBJECTIVES:

- To make the students expert in domain specific knowledge.
- To develop professionals with idealistic, practical and moral values.
- To facilitate the students with emerging technology.

From the list of skill development courses declared by the department, the students are expected to acquire the skill and get certified. This will be evaluated at the end of the semester by the faculty.

Department of Computer Science and Engineering

Subject Code: **BEN18SK1**	Subject Name : **SOFT SKILL I**	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	**ETL**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To create awareness in students, various top companies helping them improve their skill set matrix, leading to develop a positive frame of mind.
- To help students be aware of various techniques of candidate recruitment and help them prepare CV's and resume.
- To help student how to face various types of interview, preparing for HR, technical interviews.
- To help students improve their verbal reading, narration and presentation skills by performs various mock sessions.

COURSE OUTCOMES (COs) : (3- 5)
Students will be able to

CO1	Be aware of various top companies leading to improvement in skills amongst them.
CO2	Be aware of various candidate recruitment techniques like group discussion, interviews and be able to prepare CV's and resumes.
CO3	Prepare for different types of interviews and be prepared for HR and technical interviews.
CO4	Improve their verbal, written and other skills by performing mock sessions.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**3**
CO2	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**3**
CO3	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**3**
CO4	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**1**	**1**	**3**	
CO2	**1**	**1**	**3**	
CO3	**1**	**1**	**3**	
CO4	**1**	**1**	**3**	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
			✓						✓			

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BEN18SK1	SOFT SKILL I	ETL	0	0/0	3/0	1

UNIT I **6 Hrs**

Creation of awareness of top companies / improving skill set matrix / Development of positive frame of mind / Creation of self-awareness.

UNIT II **6 Hrs**

Group discussions / Do's and don'ts – handling group discussions / what evaluators look for interpersonal relationships / Preparation of Curriculum Vitae / Resume.

UNIT III **6 Hrs**

Interview – awareness of facing questions – Do's and don'ts of personal interview / group interview, enabling students to prepare for different proce3dures such as HR interviews and Technical Interviews / self-introductions.

UNIT IV **6 Hrs**

Verbal aptitude, Reading comprehension / narration / presentation / Mock Interviews.

UNIT V **6 Hrs**

Practical session on Group Discussion and written tests on vocabulary and reading comprehension

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Hours: 30

Department of Computer Science and Engineering

SEMESTER - V

Subject Code: **BCS18006**	Subject Name : **OPERATING SYSTEMS**	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BCS18004	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- The students will understand the concepts of Operating System and process.
- Illustrate the Scheduling of a processor for a given problem instance, identify the dead lock situation and provide appropriate solution, analyze memory management techniques and implement page replacement Algorithm, understand the implementation of file systems and directories.
- To appreciate emerging trends in operating systems.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Remember and Understand functions, structures and history of operating systems
CO2	Analyze various functions of CPU processing algorithms
C03	Understand the concept of hazard and analyze with prevention process.
C04	Analyze various memory management schemes
C05	Apply the functionality of file systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**
CO2	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**1**	**2**	**2**	**2**	**2**
C03	**3**	**3**	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**2**
C04	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**2**
C05	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**1**	**2**
CO2	**3**	**3**	**1**	**2**
C03	**3**	**3**	**1**	**2**
C04	**3**	**3**	**2**	**2**
C05	**3**	**3**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18006	OPERATING SYSTEMS	Ty	3	0/0	0/0	3

UNIT ICONCEPTS & PROCESSES **9 Hrs**

Computer system architecture-operating system structure-operations-management of process,memory,storage-protection and security-Operating System Services-System Calls-types-System Programs-System Structure-Virtual Machines-System Design and Implementation- Process concept-Process Scheduling-Operation on Process-Cooperating Processes- Inter Process Communication

UNIT IIPROCESS MANAGEMENT, SYNCHRONIZATION AND DEADLOCKS **9 Hrs**

Threads-Multithreading Models. CPU Scheduling concepts-Scheduling Criteria-Scheduling Algorithms-Threads and Multiple-Processor Scheduling-Real Time Scheduling- - Process Synchronization-The Critical Section Problem-Synchronization-Petersonsolution,mutex-Hardware-Semaphores monitor-Deadlocks-Deadlock Characterization-Methods of Handling Deadlocks-Deadlock Prevention-Deadlock Avoidance-Deadlock Detection-Recovery form Deadlock

UNIT III MEMORY MANAGEMENT **9 Hrs**

Main Memory-Swapping-Contiguous Memory Allocation - Address Translation - Paging - Segmentation – Virtual memory-Demand paging-page replacement-thrashing-allocating Kernal memory.

UNIT IVSTORAGE MANAGEMENT **9 Hrs**

Files And Secondary Storage Management: File Concepts - Access Methods - Directory Structure - File System Mounting - File Sharing - Protection - File System Structure - Implementation - Recovery - Disk Structure - Disk Scheduling - Disk Management

UNIT V CASE STUDY **9 Hrs**

Special purpose systems -Open source operating systems-Operating system generation-Examples of IPC systems-threading Issues-Operating system examples- Algorithm Evaluation of scheduling algorithms- Classical Problems Of Synchronization-Synchronization examples-Intel 32 bit and 64 bit architectures-ARM architecture-STREAMS.

Total Hours: 45

TEXT BOOK:

1.Silberschatz. Galvin. Gagne (2012) Operating System Concepts (9th ed.), John Wiley

REFERENCE BOOKS:

1. *D.M.Dhamdhere. D. M. (2012) Operating Systems, (3 rd ed.), Tata McGraw Hill*
2. *Tanenbaum (2015) Modern Operating Systems,Pearson Publication.*
3. *William Stallings (2015) Operating Systems (8 th ed.) Prentice Hall of India*

Department of Computer Science and Engineering

Subject Code: **BCS18007**	Subject Name : **COMPUTER NETWORKS**	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The students will be have knowledge of the networks functions
- To understand how communication takes place in various mediums
- To learn about the protocols for data communication in the network layers
- To study about the various network algorithms for smooth data communication

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students will understand and remember how network works.
CO2	Students will have knowledge on IP address and analyze the protocols.
CO3	Apply knowledge about protocols to avoid congestion.
CO4	Acquaintance to apply algorithms in networks.
CO5	Will understand how layers of networks work.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**1**	**2**	**2**	**3**	**3**	**1**	**3**	**3**	**3**	**2**
CO3	**3**	**2**	**1**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**1**	**3**	**1**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**2**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**2**
CO3	**3**	**2**	**3**	**2**
CO4	**3**	**1**	**3**	**2**
CO5	**3**	**3**	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18007	COMPUTER NETWORKS	Ty	3	0/0	0/0	3

UNIT IINTRODUCTION **9 Hrs**

Introduction to computer networks and uses - Network: devices, topology, types - Reference model - The physical layer - The theoretical basis for data communication - Transmission media: Guided and unguided- Public Switched Telephone Network.

UNIT IIDATA LINK LAYER **9 Hrs**

Data link layer design issues - Error detection and correction - Sliding window protocols- HDLC –Channel access on links: SDMA – TDMA - FDMA – CDMA - ETHERNET - 802.11, 802.16 - Bridges and Switches-Bluetooth

UNIT IIINETWORK LAYER **9 Hrs**

Network layer design issues - Circuit switching – Packet switching – Virtual circuit switching-Routing algorithms – Congestion control algorithms - Internetworking- Network layer in Internet -IPV6

UNIT IVTRANSPORT LAYER **9 Hrs**

Transport layer design issues - Transport protocols - Simple transport protocol - Internet transport protocols UDP, TCP - Flow Control – Congestion control - Congestion avoidance

UNIT VAPPLICATION LAYER **9 Hrs**

Domain name system - Electronic mail – Introduction to World Wide Web: HTTP, SNMP, Telnet, FTP,RTP.

Total Hours: 45

TEXT BOOKS:

1. Peterson Davie (2012) Computer Networks - A System Approach (2nd ed.), Morgan Kauffman Harcourt Publishers.
2. James F. Kurose, Keith W. Ross Computer Networking: A Top-Down Approach / Edition 6, Pearson publication, 2012.

REFERENCE BOOKS:

1. *Andrew S. Tanenbaum. David J. Wetherall ,"Computer Networks "5th Edition PHI, 2011*
2. *William Stallings," Data and computer communications", PHI, 2001*
3. *Douglas E. comer," Internetworking with TCP/IP-Volume-I", PHI, 5th edition 2006*
4. *Godbole, "Data communication and networking", TMH, 2004.*
5. *Forouzan B. A., "Data Communications and networking", TMH, 2003.*

Department of Computer Science and Engineering

Subject Code: BCS21B03	Subject Name : Fundamentals of Block Chain Technology	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To Understand the emerging models for Blockchain Technology.
- To Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
- To provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers,
- To Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand emerging abstract models for Blockchain Technology.
CO2	Identify major research challenges and technical gaps
CO3	Understand of the function of Blockchain as a method of securing distributed ledgers
CO4	Analyze the consensus on their contents is achieved, and the new applications that they enable.
CO5	Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	3	2	2	3	3	2
CO3	3	3	3	3	3	2	2	2	3	2	2	2
CO4	3	3	3	3	3	3	2	3	3	2	3	2
CO5	3	3	3	3	3	2	2	3	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	2	2
CO3	3	2	3	2
CO4	3	3	3	3
CO5	3	3	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21B03	Fundamentals of Block Chain Technology	Ty	3	0/0	0/0	3

UNIT – I INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT – II BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block
Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network

UNIT – III BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environmentPaxos

UNIT – IV DISTRIBUTED CONSENSUS

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance

UNIT – V HYPER LEDGER FABRIC & ETHERUM

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, TruffleDesign and issue Crypto currency, Mining, DApps, DAO Blockchain Applications

Internet of Things-Medical Record Management System-Blockchain in Government and Blockchain Security-Blockchain Use Cases –Finance

TOTAL: 45

REFERENCES

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017.

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015

Department of Computer Science and Engineering

Subject Code: BCS18008	Subject Name : SYSTEM SOFTWARE AND PRINCIPLES OF COMPILER DESIGN	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BCS18003	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Kindly don't make any changes in pre exiting objectives…

COURSE OUTCOMES (COs) : (3- 5)	
CO1	Recall the basic concepts of computation.
CO2	Understand the basics of Assemblers, Loaders, Linkers and Macro processors to compare the architectures.
CO3	Ability to differentiate and construct an automata.
CO4	Apply the principles of compiler to generate the target code.
CO5	Design a simple compiler using the construction tools.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	2	1	2	1	2	3	2	1
CO2	3	2	2	1	2	2	2	2	3	2	2	2
CO3	3	2	3	2	2	2	1	3	3	3	3	3
CO4	3	3	3	2	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	3	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	2	3	2	2
CO3	2	1	1	1
CO4	3	1	3	2
CO5	1	1	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18008	SYSTEM SOFTWARE AND PRINCIPLES OF COMPILER DESIGN	Ty	3	0/0	0/0	3

UNIT I ASSEMBLERS & MACROS **6 Hrs**

Overview of Language processors – Assemblers: Design of two pass assemblers - single pass assemblers MACRO: Macro definition- macro call – macro expansion- nested macroadvanced macro facilities.

UNIT II LINKERS & LOADERS **6 Hrs**

Loaders and Linkers: Functions – design - bootstrap loader - machine dependent loader features - machine independent loader features - loader design options - Dynamic linking and Linkage Editors – Implementation Examples

UNIT III COMPILERS : GRAMMARS & AUTOMATA **9 Hrs**

Structure of compiler-Languages –Context free grammar - regular expression - Recognizing of patterns - finite automation (deterministic & non deterministic) Conversion of NDFA to DFA - Conversion of regular expression to DFA – Thompson's construction- minimization of NDFA - Lexical analysis- handles - token specification - design of lexical analysis (LEX) - Automatic generation of lexical analyzer - input buffering - A language for specifying lexical analyzers - implementation of lexical analyzer.

UNIT IV SYNTAX ANALYSIS – PARSING **12 Hrs**

Definition - role of parsers - top down parsing - bottom-up parsing - Left recursion - left factoring - Handle pruning , Shift reduce parsing - operator precedence parsing – FIRST- FOLLOW- LEADING- TRAILING- Predictive parsing - recursive descent parsing. LR parsing – LR (0) items - S.LR parsing – Canonical LR - LALR parsing - generation of LALR - error recovery

UNIT V SYNTAX DIRECTED TRANSLATION & CODE OPTIMIZATION **12 Hrs**

Intermediate Languages - prefix - postfix - Quadruple - triple - indirect triples – syntax tree- Evaluation of expression - three-address code- Synthesized attributes – Inherited attributes – Conversion of Assignment statements- Boolean expressions –Backpatching - Declaration - CASE statements

CODE OPTIMIZATION: Local optimization- Loop Optimization techniques – DAG – Dominators- Flow graphs – Storage allocations- Peephole optimization – Issues in Code Generation.

Total Hours: 45

TEXT BOOKS:

1. Alfred V Aho, Jeffrey D Ullman, Ravi Sethi, "Compilers, Techniques, and Tools", Addison Wesley,
2. 2006
2. Leland L Beck, D. Manjula, "System Software",III Edition, Pearson Education -- First Impression, 2007

REFERENCE BOOKS:

1. *D.M.Dhamdhere (2009) Systems Programming and Operating Systems,(2nd ed.), Tata McGraw-Hill Publishing Company Ltd*
2. *John J Donavan (2009) System Programming, Tata McGraw- Hill Publishing Company Ltd*
3. *John R. Levine, "Linkers & Loaders", Morgan Kauffman, 2003.*
4. *Allen Holub I. (2007) Compiler Design in C, PHI*
5. V Raghavan (2009) Principles of compiler, Tata Mc Graw Hill
6. Kenneth C Louden (2003) Compiler Construction Principles & Practice Thompson learning

Department of Computer Science and Engineering

Subject Code	Subject Name :	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18ET2	**COMPUTER GRAPHICS**					
	Prerequisite: BES18ET2	ETL	1	0/1	3/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

The student should be made to:

- Understand the output primitives, two dimensional graphics and their transformations.
- Understand the three dimensional graphics and their transformations.
- Understand illumination and color models
- Learn to create animations

COURSE OUTCOMES (COs) : (3- 5)

CO1	Explain the various output primitives ,transform geometrical structures and graphics systems
CO2	Understand 2D transformations, viewing and clipping techniques
CO3	Explain the 3D objects and projections and solving numerical problems on 3D transformation and polygon rendering methods
CO4	Apply different shading,colour model and selection of colour
CO5	Discuss animation sequences and graphics realism

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	1	3	1	1	1	2
CO2	3	2	1	1	2	1	1	3	2	1	1	3
CO3	3	2	2	1	2	1	1	3	2	2	1	3
CO4	3	2	2	1	2	1	1	3	2	1	1	3
CO5	3	3	3	2	2	2	2	3	2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2
CO2	3	3	2	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	3	3	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18ET2	COMPUTER GRAPHICS	ETL	1	0/1	3/0	3

UNIT I OUTPUT PRIMITIVES **9 Hrs**

Output primitives-Line drawing algorithms-Loading the frame buffer-Line function-Circle generation algorithms –Ellipse generation algorithms- Attributes of output primitives-Numerical problem solving and programs on line, circle and ellipse drawing algorithms

UNIT II TWO DIMENSIONAL TRANSFORMATION & VIEWING **9 Hrs**

Two dimensional transformations- Matrix representations and homogeneous coordinates - Composite transformations – two dimensional viewing -Window to view port transformation - Clipping operations - Point clipping - Line clipping (Cohen - Sutherland line Clipping) - Polygon clipping(Sutherland - Hodgeman algorithm) –Numerical problem solving and programming on two dimensional transformation ,viewing and clipping

UNIT III THREE DIMENSIONAL GRAPHICS **9 Hrs**

Three dimensional concepts - Three dimensional object representation -Three Dimensional Transformations - Visible surface detection methods (Back Face Detection - Depth Buffer Method - Scan Line Method) - Numerical problem solving and programming on three dimensional transformations

UNIT IV POLYGONRENDERING METHODS AND COLOUR MODELS **9 Hrs**

Constant-Intensity Shading – Gouraud Shading- Phong Shading- chromaticity diagram - RGB colour model - YIQ colour model - CMY colour model - Colour selection

UNIT V ANIMATION GRAPHICS **9 Hrs**

Design of Animation sequences – animation function – raster animation – key frame systems – motion specification – morphing - create Interactive animation for gamming

Total Hours: 45

TEXT BOOKS:

1. Donald, D. Hearn. Pauline, Baker, M. Warren, Carithers. (2010) Computer graphics with Open GL, (4th ed.)
2. Computer Graphics (Special Indian Edition) (Schaum's Outline Series) 2nd Edition, 2006 (English, Paperback, Xiang, Plastock, Avadhani), McGraw Hill Education (India) Private Limited

REFERENCE BOOKS:

1. *John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, Steven K. Feiner and Kurt Akeley ,"Computer Graphics: Principles and Practice", 3rd Edition, Addison-Wesley Professional,2013.*
2. *Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.*

Subject Code: **BCS18L05**	Subject Name : **NETWORK PROGRAMMING LAB**	**Ty /Lb /ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: : **BCS18ET2**	Lb	0	0/0	3/0	**1**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Hands on Experience to design an application using TCP and UDP sockets.
- Hands on Experience to design an interface to transfer a file between two ends using FTP
- Hands on Experience to develop a RMI application for specific operation
- To have a knowledge to work with Network Simulators

COURSE OUTCOMES (COs) : (3- 5)

CO1	Ability to apply the knowledge in Socket Programming using TCP and UDP
CO2	To design Client /Server Application Program by remembering the standards of protocol.
CO3	Ability to create a Server based application using RMI and RPC concepts.
CO4	Understand how network stimulator works.
CO5	Can analyze the state of network.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**1**	**2**	**2**	**3**	**3**	**1**	**3**	**3**	**3**	**2**
CO3	**3**	**2**	**1**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**1**	**3**	**1**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**2**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**

Department of Computer Science and Engineering

CO1	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**2**
CO5	**3**	**2**	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L05	NETWORK PROGRAMMING LAB	Lb	0	0/0	3/0	1

LIST OF EXPERMENTS:

1. Networking Commands with options. (Case Study).
2. Socket program to extent communication between two deferent ends using TCP.
3. Socket program to extent communication between two deferent ends using UDP
4. Create a Socket (TCP) between two computers and enable file transfer between them.
5. Implementation of RPC in server-client model
6. Implementation of ARP/RARP.
7. HTTP Socket program to download a web page.
8. File transfer in Client-Server architecture using following methods
   a) Using RS232C b) Using TCP/IP
9. To implement RMI (Remote Method Invocation)
10. Write a network program to broadcast/ multicast a message to a group in the same network.
11. Demonstration of Network Simulators.

Department of Computer Science and Engineering

Subject Code: BCS18L06	Subject Name : OPERATING SYSTEMS LAB	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: NIL	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/LbETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn to Create processes and implement IPC
- To learn to use system calls through C programs
- To learn to use the file system related system calls
- To gain knowledge to Analyze the performance of the various Page Replacement Algorithms
- To learn to Implement File Organization and File Allocation Strategies

COURSE OUTCOMES (COs) : (3- 5)

CO1	Create processes and implement IPC
CO2	Implement Deadlock avoidance and Detection Algorithms
CO3	Compare the performance of various CPU Scheduling Algorithms
CO4	Analyze the performance of the various Page Replacement Algorithms
CO5	Implement File Organization and File Allocation Strategies

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1	1	1	2	2	1	1
CO2	3	3	2	1	1	1	2	2	2	1	1	1
CO3	3	3	2	2	2	2	2	2	1	1	1	2
CO4	3	3	2	1	1	1	1	1	2	1	1	1
CO5	3	3	2	2	2	2	2	1	1	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1
CO2	3	2	2	1
CO3	3	2	2	2
CO4	3	1	2	1

Department of Computer Science and Engineering

CO5	3	1	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✔					

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L06	OPERATING SYSTEMS LAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS:

1. Basic UNIX commands – learning and usage.
2. Shell Programming.
3. File system related system calls. (Learn to create, open, read, write, seek into, close files & open, read, write, search, close directories).
4. Process management – Fork, Exec (Learn to create a new process and to overlay an executable binary image on an existing process).
5. Inter-process communication between related processes using pipes.
6. Process synchronization using semaphores (Solutions to synchronization problems like producer consumer problem, dining philosopher's problem etc...).
7. Inter-process communication among unrelated processes using Shared memory.
8. Inter-process communication among unrelated processes using Message Queues.
9. CPU Scheduling algorithms.
10. Contiguous memory allocation strategies – best fit, first fit and worst fit strategies.
11. Page replacement algorithms

Department of Computer Science and Engineering

Subject Code: BCS18L07	Subject Name : SYSTEM SOFTWARE AND COMPILER DESIGN LAB	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BCS18003	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- The students will be able to design assembler, loader and linker
- The students will be able to construct the NFA and DFA for a regular expression and implement various phases of compiler.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Implement Symbol table using C/C++ Language
CO2	Design an assembler, loader and linker.
CO3	Construct the NFA and DFA for a regular expression.
CO4	Implement the front end and back end of a compiler.
CO5	Implement different parsing algorithms.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	2	2	2	3	2	3	3
CO2	3	2	3	2	2	2	2	2	3	2	3	3
CO3	3	3	3	2	2	2	1	2	2	1	2	2
CO4	3	3	3	3	3	2	2	2	2	2	3	3
CO5	3	3	3	2	3	2	1	2	2	1	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	1
CO3	2	3	2	2
CO4	3	2	3	2
CO5	3	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

							✔					

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L07	**SYSTEM SOFTWARE AND COMPILER DESIGN LAB**	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS:

1. To implement the Symbol Table using C / C++
2. To implement the Assembler using C / C++
3. To implement the Loader using C / C++
4. To implement the Linking Loader using C / C++
5. Lexical Analyzer using “C”.
6. Constructing NFA from a regular expression
7. Constructing DFA from a regular expression
8. To eliminate Left Factoring
9. Constructing top down parsing table
10. To implement the Shift-reduce parsing algorithm.
11. To implement the Operator-Precedence parsing algorithm
12. Constructing LR-Parsing table.
13. Generate a code for a given intermediate code
14. Generate Machine code

Department of Computer Science and Engineering

Subject Code: BCS18TS2	Subject Name : TECHNICAL SKILL II (EVALUATION)	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To make the students expert in domain specific knowledge.
- To develop professionals with idealistic, practical and moral values.
- To facilitate the students with emerging technology

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the domain specific knowledge.
CO2	Able to apply idealistic, practical and moral values.
CO3	Familiarize with emerging technology

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	2	2	1	1	1	3	1
CO2	3	3	2	3	3	2	2	2	2	2	3	1
CO3	3	3	3	3	3	2	2	1	2	2	3	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1
CO2	3	3	1	3
CO3	3	3	1	3

3/2/1indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
								✔	

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18TS2	**TECHNICAL SKILL II (EVALUATION)**	Lb	0	0/0	3/0	1

OBJECTIVES:

- To make the students expert in domain specific knowledge.
- To develop professionals with idealistic, practical and moral values.
- To facilitate the students with emerging technology.

From the list of skill development courses declared by the department, the students are expected to acquire the skill and get certified. This will be evaluated at the end of the semester by the faculty.

Department of Computer Science and Engineering

SEMESTER - VI

Subject Code: **BCS18009**	Subject Name : **OBJECT ORIENTED SOFTWARE ENGINEERING**	**Ty /Lb /ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: BCS18002	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Understand the phases in a software development
- Understand fundamental concepts of requirements engineering and Analysis Modelling.
- Understand the different approach for Object Oriented Design
- Learn various testing and maintenance measures

COURSE OUTCOMES (COs) : (3- 5)

CO1	Identify the key activities in managing a software Development.
CO2	Summarize different process models.
CO3	Analyze on various architectural designs using UML diagrams.
CO4	Apply systematic procedure for software design and deployment.
CO5	Compare and contrast the various testing and maintenance

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**3**	**3**	**1**	**1**	**2**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

				✔								

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18009	**OBJECT ORIENTED SOFTWARE ENGINEERING**	Ty	3	1/0	0/0	4

UNIT I SOFTWARE DEVELOPMENT LIFE CYCLE **12 Hrs**

Introduction -Software process models: The waterfall model, Incremental development, Reuse-oriented software engineering – OOSD Life cycle: Process activities Software specification – Software design and implementation – Software validation – Software evolution- Process iteration: Prototyping, Incremental delivery, Boehm's spiral model - Agile methodology - OMT – Booch Methodology – Jacobson methodology – patterns – unified approach

UNIT II OBJECT ORIENTED SOFTWARE REQUIREMENTS AND ANALYSIS 12 Hrs

Requirements engineering: Functional and non-functional requirements – The software requirements document – System Modeling: Context models – Interaction models - Structural models - Behavioral models - **UML**: Static and Dynamic Models–Introduction to UML -Use case Diagram – Class diagrams –Dynamic modeling-Packages and Model Organization-UML Extensibility - Use case model – Creation of Classes: Noun Phrase Approach – Identifying Object Relationships, Attributes and Methods

UNIT III OBJECT ORIENTED SOFTWARE DESIGN **15 Hrs**

Architectural design: Architectural design decisions - Architectural views - Architectural patterns - Application architectures - Design and implementation: Object-oriented design using the UML - OO Design Axioms – Corollaries- Design Patterns- Designing Classes: Class Visibility – refining Attributes – Designing Methods – Access layer: Object Store and Persistence- OODBMS – Table Class mapping –Designing Access layer classes - View layer: Designing Interface Objects

UNIT IV TESTING **9 Hrs**

Software testing: Development testing - Test-driven development - Release testing - User testing - Quality Assurance Test – Testing strategies – Impact of OO Testing – Test Cases – Test Plan – Continuous Testing - Myers's Debugging principles.

UNIT V SOFTWARE QUALITY & MANAGEMENT **12 Hrs**

Project management: Risk management- Managing people – Teamwork - Project planning: Software pricing - Plan-driven development - Project scheduling - Agile planning - Estimation techniques Quality management: Software quality - Software standards - Reviews and inspections - Software measurement and metrics - Configuration management: Change management - Version management - System building - Release management

Total Hours: 60

TEXT BOOK:

1. Yogesh Singh, Ruchika Malhotra (2012), Object – Oriented Software Engineering PHI Learning Private Limited.

REFERENCE BOOKS:

1. *Ian Sommerville (2008) Software Engineering (9th ed.) Pearson Education Asia*
2. *Ali Bahrami (2008) Object Oriented System Development McGraw Hill international*

3. *Roger S. Pressman (2010) Software Engineering: A Practitioner Approach (8th ed.) McGraw hill Publications*
4. *Grady Booch (2009) Object oriented Analysis & design ,Pearson Education India*

Department of Computer Science and Engineering

Subject Code: **BIT18003**	Subject Name **WEB TECHNOLOGY AND WEB SERVICES**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: BIT18I01	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- The students will have knowledge about the HTML5 and CSS3
- To learn the concepts of XML and SOAP.
- To study about the JSP and understand to develop basic level application and advance application on web pages.
- To study about the concept of Web services.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Remember the concept of Hyper Text markup language and CSS
CO2	Understand the skills that will enable to design and build high level web enabled applications.
CO3	Analyze the applicability of Scripting language as per current software industry standards..
CO4	Apply the concept of the server side programming to develop the application on web pages.
CO5	Acquaint the latest programming language for the concepts of web services

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**2**
CO2	**3**	**2**	**1**	**2**	**2**	**3**	**3**	**1**	**3**	**3**	**3**	**2**
CO3	**3**	**2**	**1**	**3**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**2**
CO4	**3**	**3**	**2**	**3**	**1**	**3**	**1**	**3**	**2**	**3**	**3**	**2**
CO5	**3**	**2**	**2**	**2**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**2**
CO3	**3**	**2**	**3**	**2**
CO4	**3**	**1**	**3**	**2**
CO5	**3**	**3**	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

		✔										

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BIT18003	**WEB TECHNOLOGY AND WEB SERVICES**	Ty	3	0/0	0/0	3

UNIT I HTML 5 & CSS 3 **9 Hrs**

HTML – forms – frames – tables – web page design – Dynamic HTML – introduction – cascading style sheets – object model and collections –event model – filters and transition – data binding – data control – ActiveX control – handling of multimedia data

Unit II XML **9 Hrs**

Role of XML - XML and The Web - XML Language Basics - Revolutions of XML - Service Oriented Architecture (SOA). XML - Name Spaces - Structuring With Schemas and DTD - Presentation Techniques - Transformation - XML Infrastructure.

Unit III SOAP **9 Hrs**

Overview of SOAP - HTTP - XML-RPC - SOAP: Protocol - Message Structure - Intermediaries - Actors - Design Patterns and Faults - SOAP With Attachments. Introduction to SGML - COM – DCOM – CORBA.

UNIT IV SERVER SIDE PROGRAMMING **9 Hrs**

Introduction to Servlets and Java Server Page (JSP), Servlets lifecycle, Servlet Classes and Sessions.JSP Application Design, JSP objects, sharing data between JSP pages, Sharing Session and Application Data, Database Programming using JDBC, development of java beans in JSP.

Unit V WEB SERVICES **9 Hrs**

Overview - Architecture - Technologies - UDDI - WSDL - ebXML - SOAP and Web Services in E-Com, Rest full in Web service.

Total Hours: 45

TEXT BOOKS:

1. Richard Clark, Oli Studholme, Christopher Murphy and Divya Manian,"Beginning HTML5 and CSS 3" @ Apress , 2012.
2. Frank. P. Coyle, "XML, Web Services and The Data Revolution", Pearson Education, 2002.
3. Phil Hanna, "JSP: The Complete Reference", McGraw-Hill, 2001

REFERENCE BOOKS:

1. *Laura Lemay, Rafe Coburn, Jennifer Kyrnin, "Mastering HTML, CSS & JavaScript Web Publishing", Pearson Education.2015*
   Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services", Pearson Education, 2004.

Department of Computer Science and Engineering

Subject Code:	Subject Name	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21B04	Blockchain And Cryptocurrency Technologies					
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To Understand and apply the fundamentals of Cryptography in Cryptocurrency
- To gain knowledge about various operations associated with the life cycle of Blockchain and Cryptocurrency
- To deal with the methods for verification and validation of Bitcoin transactions
- To demonstrate the general ecosystem of several Cryptocurrency

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the fundamentals of Cryptography in Cryptocurrency
CO2	Understand the Various Operations of Blockchain and Cryptocurrency.
CO3	Analyze the methods for verification and validation of Bitcoin transactions
CO4	Design the general ecosystem of several Cryptocurrency
CO5	Apply the principles, practices and policies associated Bitcoin business

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	3	2	3	2	3	3
CO2	3	3	2	2	2	1	2	1	2	2	1	1
CO3	3	3	3	1	3	2	2	2	2	2	2	2
CO4	3	3	2	2	1	3	1	1	2	1	1	2
CO5	3	3	2	2	2	2	3	1	1	1	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	2	2	2	2
CO3	3	1	2	1
CO4	2	2	1	2
CO5	3	2	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

		✔										

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21B04	BLOCKCHAIN AND CRYPTOCURRENCY TECHNOLOGIES	Ty	3	0/0	0/0	3

UNIT-I INTRODUCTION TO CRYPTOGRAPHY AND CRYPTOCURRENCIES
Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency. How Blockchain Achieves and How to Store and Use Decentralization-Centralization vs. Decentralization-Distributed consensus, Consensus with- out identity using a blockchain, Incentives and proof of work. Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

UNIT-II MECHANICS OF BITCOIN
Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bit- coin network, Limitations and improvements. Bitcoin Mining The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies

UNIT - III BITCOIN AND ANONYMITY
Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash. Community, Politics, and Regulation Consensus in Bitcoin, Bitcoin Core Software, Stakeholders: Who‟s in Charge, Roots of Bitcoin,

UNIT-IV GOVERNMENTS NOTICE ON BITCOIN,
Anti Money Laundering Regulation, New York‟s Bit License Proposal. Bitcoin as a Platform: Bitcoin as an Append only Log, Bitcoins as Smart Property, Secure Multi Party Lotteries in Bitcoin, Bitcoin as Public Randomness, Source-Prediction Markets, and Real World Data Feeds.

UNIT-V ALTCOINS AND THE CRYPTOCURRENCY ECOSYSTEM
Altcoins: History and Motivation, A Few Altcoins in Detail, Relationship Between Bitcoin and Altcoins, Merge Mining-Atomic Crosschain Swaps-6 BitcoinBacked Altcoins, Side Chains, Ethereum and Smart Contracts. Recent Trends and applications.

Total Lecture hours: 45 hours

Text Book(s)
Narayanan, A., Bonneau, J., Felten, E., Miller, A., and Goldfeder, S. (2016). Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press.

Reference Books
1 Antonopoulos, A. M. (2014). Mastering Bitcoin: unlocking digital cryptocurrencies. OReilly Media, Inc.”.

Franco, P. (2014). Understanding Bitcoin: Cryptography, engineering and economics. John Wiley and Sons.
Mode

Department of Computer Science and Engineering

Subject Code: BCS18ET3	Subject Name : PHP / MYSQL	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BCS18L03	ETL	1	0/1	3/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- The students will learn the technology about scripting languages basics.
- To learn install PHP and work on that.
- To learn the basic and advance concepts of PHP language.
- To understand install the MySQL and work with MySQL database in admin level and client to store and retrieve the data in application with PHP.
- To learn design basic and advance applications using PHP and MySQL.

COURSE OUTCOMES (COs) : (3- 5)

CO1	**List the fundamentals of scripting language.**
CO2	**Demonstrate a variety of database concept.**
CO3	**Classify the various web technique designs.**
CO4	**Apply systematic procedure for developing different databases.**
CO5	**Build to develop an application using PHP.**

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	2	2	3	2	3	3	3	3
CO2	3	3	3	1	3	3	2	3	3	3	2	3
CO3	3	3	3	1	3	2	1	3	3	3	3	3
CO4	3	3	3	2	3	2	3	3	3	3	3	3
CO5	3	3	3	3	3	2	2	1	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	2	3	3
CO3	3	2	3	3
CO4	3	2	3	3
CO5	3	2	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18ET3	**PHP / MYSQL**	ETL	1	0/1	3/0	3

UNIT IIntroduction **9 Hrs**

Introduction to Web server and Web browser - Introduction to PHP - Lexical structure - Language basics - Function and String - Default parameters - Variable function, Anonymous function Printing functions - Manipulating and searching strings - Regular expressions.

UNIT IIArrays **9 Hrs**

Identifying elements of an array - Indexed Vs Associative arrays - Storing data in arrays - Multidimensional arrays - Extracting multiple values - Converting between arrays and variables - Traversing arrays - Sorting - Action on entire arrays - Using arrays.

UNIT III Objects and Web Techniques **9 Hrs**

OOP – Class – Objects – Introspection – Serialization – Inheritance - Interfaces - Encapsulation
HTTP Basics – Variables – Server information – Processing Form, Setting Response headers – maintain state – SSL.

UNIT IV Databases and Graphics **9 Hrs**

Using PHP to access Database – Relational Databases and SQL – MySQLi Object interface – SQLite- Direct file level manipulation – mongoDB.Embedding an image in a page – Basic Graphic concepts – Creating and drawing images.

UNIT VFiles and Directories **9 Hrs**

Filter input – cross-site scripting – Escape output – Session fixation – file uploads – file access – PHP code – Shell commands – Core libraries – Templating systems – Handling output – Error Handling – Performance Tuning.

Total Hours: 45

TEXT BOOKS:

1. **www.spoken-tutorials.org**
2. Kevin Tatroe, Peter MacIntyre, etal " Programming PHP" O REILLY 3rd Edition – 2013
3. Luke Welling, Laura Thomson " PHP and MySQL Web Development" Person Education 5th Edition – 2016.

Reference Books:

1. *Robin Nixon "Learning PHP, MySQL & JavaScript" O REILLY – 5th Edition - 2015.*
2. *Elizabeth Naramore, Jason Gerner, etal "Beginning PHP5, Apache, MySQL web development" Wrox Publishing – 2005.*

Department of Computer Science and Engineering

Subject Code: BCS18L08	Subject Name : OBJECT ORIENTED SOFTWARE ENGINEERING LAB	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BCS18L02	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Identify Use Cases and develop the Use Case model.
- Identify the business activities and develop an UML Activity diagram.
- Identity the conceptual classes and develop a domain model with UML Class diagram.
- Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
- Draw the State Chart diagram.
- Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
- Implement the Technical services layer.
- Implement the Domain objects layer.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Show the importance of systems analysis and design in solving complex problems.
CO2	Show how the object-oriented approach differs from the traditional approach to systems analysis and design.
CO3	Construct various UML models (including use case diagrams, class diagrams, interaction diagrams, state chart diagrams, activity diagrams, and implementation diagrams) using the appropriate notation. ·
CO4	Recognize the difference between various object relationships: inheritance, association, whole-part, and dependency relationships. ·
CO5	Show the role and function of each UML model in developing object-oriented software.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	1	3	3	3	2	3
CO2	3	3	3	3	3	1	1	3	3	2	1	3
CO3	3	3	3	3	3	1	1	3	3	2	1	3
CO4	3	3	3	3	3	1	1	3	3	3	2	3
CO5	3	3	3	3	3	1	1	3	3	3	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4		
CO1	3	3	3	3		
CO2	3	3	3	3		
CO3	3	3	3	3		
CO4	3	3	3	3		
CO5	3	3	2	3		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✔					

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L08	OBJECT ORIENTED SOFTWARE ENGINEERING LAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS:

1. Study of case tools such as rational rose or equivalent tools
2. Railway reservation system
3. Student Mark Analysis system
4. Payroll processing application
5. Inventory system
6. Automating the Banking process
7. Course Registration System
8. Library management system
9. Passport Automation System

SOFTWARE REQUIRED:

Languages: C/C++/JDK 1.3, JSDK, WEB BROWSER & UML
Any Front End Tools (Like VB, VC++, Developer 2000)
Any Back End Tools (Like Oracle, MS-Access, SQL, DB2)
Modelling and Design : Rational Rose

Department of Computer Science and Engineering

Subject Code: BIT18L03	Subject Name **WEB TECHNOLOGY AND WEB SERVICES LAB**	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite:BIT18IL01	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn about to develop an own web site.
- To have knowledge to design webpage using CSS.
- To have knowledge to design a dynamic web site using XML and XSLT.
- To learn and develop to design mail communication.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Remember and build high level web enabled applications.
CO2	Understanding the concept of CSS to develop interactive web pages.
CO3	Ability to design a dynamic web site using XML and XSLT
CO4	Able to learn and develop to design mail communication
CO5	Create applications using different types of web services and frameworks

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	3	3	2	3	2	3	3
CO2	3	3	3	2	3	3	2	2	3	3	2	2
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	2	3	3	2	2	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	2	2
CO3	2	3	3	3
CO4	2	1	2	3
CO5	3	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✔					

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BIT18L03	**WEB TECHNOLOGY AND WEB SERVICES LAB**	**Lb**	**0**	**0/0**	**3/0**	**1**

LISTOF EXPERMENTS:

1. Create a web page with the following using HTML
   i) To embed an image map in a web page
   ii) To fix the hot spots
   iii) Show all the related information when the hot spots are clicked.
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML
4. Write a program in Java to create applets incorporating the following features:
   i. Create a color palette with matrix of buttons Set background and foreground of the control text area by selecting a color from color palette.
   ii. In order to select Foreground or background use check box control as radio buttons
   iii. To set background images
5. Programs using XML – Schema – XSLT/XSL
6. Create a Web form for an online library. This form must be able to accept the Membership Id of the person borrowing a book, the name and ID of the book, and the name of the book's author. On submitting the form, the user (the person borrowing the book) must be thanked and informed of the date when the book is to be returned. You can enhance the look of the page by using various ASP.NET controls.
7. Create a JSP application. Send a simple E-Mail to your friends
8. Consider a case where we have a web Service- an airline service and a travel agent and the travel agent is searching for an airline. Implement this scenario using Web Services and Data base.

Department of Computer Science and Engineering

Subject Code: BEN18SK2	Subject Name : SOFT SKILL – II	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BEN18SK1	ETL	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To bring behavioural patterns of students.
- To train them for corporate culture.
- To create self awareness.
- To build confidence.
- To train the students for facing the interviews and develop interpersonal relationship.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Recognize and apply arithmetic knowledge in a variety of contexts.
CO2	Ability to identify and critically evaluate philosophical arguments and defend them from criticism.
CO3	Define data and interpret information from graphs.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO 9	PO10	PO1 1	PO12

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BEN18SK2	SOFT SKILL - II	ETL	0	0/0	3/0	1

CO1	3	3	3	3	3	3	1	1	3	2	3	3
CO2	2	2	2	3	1	3	1	3	3	3	3	1
CO3	3	3	3	3	3	3	2	2	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1
CO2	1	2	1	1
CO3	1	1	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
									✓			

UNIT I Logical Reasoning I

Logical Statements – Arguments – Assumptions – Courses of Action.

UNIT II Logical Reasoning II

Logical conclusions – Deriving conclusions from passages – Theme detection.

UNIT III Arithmetical Reasoning I

Number system – H.C.F & L.C.M – Problem on ages – Percentage – Profit & Loss – Ratio & Proportion – Partnership.

UNIT IV Arithmetical Reasoning II

Time & Work – Time & Distance – Clocks – Permutations & Combinations – Heights & Distances – Odd man out and Series.

UNIT V Data Interpretation

Tabulation – Bar graphs – Pie graphs – Line graphs.

REFERENCE BOOK:

1. *R.S.Agarwal, A modern approach to Logical Reasoning, S.Chand & Co., (2017).*
2. *R.S.Agarwal, A modern approach to Verbal and Non verbal Reasoning, S.Chand & Co., (2017).*
3. *R.S.Agarwal, Quantitative Aptitude for Competitive Examinations, S.Chand & Co., (2017).*
4. *A.K.Gupta, Logical and Analytical Reasoning, Ramesh Publishing House, (2014).*
5. *B.S.Sijwali, Indu sijwali, A new approach to Reasoning (Verbal and Non verbal), Arihant Publishers, (2014).*

Department of Computer Science and Engineering

Subject Code: **BCS18L09**	Subject Name : **INPLANT TRAINING / INTERNSHIP / MINI PROJECT (EVALUATION)**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite : NIL	**Lb**	**0**	**0/0**	**3/0**	**1**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The main objective of the Inplant training is to provide a short-term work experience in an Industry/ Company/ Organization

COURSE OUTCOMES (COs) : (3- 5)

CO1	Aspire an insight of an industry / organization/company pertaining to the domain of study.
CO2	Construct skills and knowledge for a smooth transition into the career.
CO3	Support field experience and get linked with the professional network.
CO4	To equip the students with industry knowledge and understanding of various possible technologies.
CO5	To impart the knowledge of various technologies form the industry resources

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**
CO4	**2**	**1**	**3**	**1**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**
CO5	**1**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**2**	**3**	**2**	**3**
CO5	**3**	**2**	**3**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

								✔				

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L09	**INPLANT TRAINING / INTERNSHIP / MINI PROJECT (EVALUATION)**	**Lb**	**0**	**0/0**	**3/0**	**1**

OBJECTIVE :

- The main objective of the In-plant training is to provide a short-term work experience in an Industry/ Company/ Organization

Department of Computer Science and Engineering

Subject Code: BCS18TS3	Subject Name : TECHNICAL SKILL III (EVALUATION)	Ty/Lb/ ETL	L	T/ S.L r	P/R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To make the students expert in domain specific knowledge.
- To develop professionals with idealistic, practical and moral values.
- To facilitate the students with emerging technology

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the domain specific knowledge.
CO2	Able to apply idealistic, practical and moral values.
CO3	Familiarize with emerging technology

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	2	2	1	1	1	3	1
CO2	3	3	2	3	3	2	2	2	2	2	3	1
CO3	3	3	3	3	3	2	2	1	2	2	3	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1
CO2	3	3	1	3
CO3	3	3	1	3

3/2/1indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills

Department of Computer Science and Engineering

								✔	

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18TS3	**TECHNICAL SKILL III (EVALUATION)**	**Lb**	**0**	**0/0**	**3/0**	**1**

OBJECTIVES:

- To make the students expert in domain specific knowledge.
- To develop professionals with idealistic, practical and moral values.
- To facilitate the students with emerging technology.

From the list of skill development courses declared by the department, the students are expected to acquire the skill and get certified. This will be evaluated at the end of the semester by the faculty.

SEMESTER – VII

Subject Code: **BCS18010**	Subject Name : **DATA WAREHOUSING AND DATA MINING**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: BCS18004	**Ty**	**3**	**00**	**0/3**	**4**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Provide an overview of the methodologies and approaches to data mining
- Gain insight into the challenges and limitations of data mining techniques and data warehousing
- Applying data mining solutions using common data mining tools

COURSE OUTCOMES (COs) : (3- 5)

CO1	Identify the functionality of the various data mining and data warehousing component
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models
CO3	Explain the analyzing techniques of various data
CO4	Describe different methodologies used in data mining and data ware housing.
CO5	Compare different approaches of data ware housing and data mining with various technologies.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**1**	**3**	**3**	**2**
CO3	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**1**	**3**	**3**	**2**
CO4	**3**	**3**	**3**	**1**	**3**	**3**	**2**	**3**	**1**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**3**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**3**	**3**
CO2	**3**	**2**	**3**	**3**
CO3	**3**	**2**	**3**	**3**
CO4	**3**	**1**	**3**	**3**
CO5	**3**	**2**	**3**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18010	**DATA WAREHOUSING AND DATA MINING**	Ty	3	0/0	0/3	4

UNIT I DATA WAREHOUSING **12 Hrs**

Introduction to Data Warehousing- Advantages- What makes Data Warehousing a reality- Data warehousing Components- Building a Data Warehouse-mapping Data Warehouse to a Multiprocessor-Architecture-DBMS Schemas for Design Support

UNIT II ETL AND BUSINESS TOOLS **12 Hrs**

Data Extraction-Cleaning and Transformation tools- Meta data. Reporting and Query tools and Application-OLAP Patterns and Models- Statistics

UNIT III DATA MINING **12 Hrs**

Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues – Data Preprocessing.- Data Cleaning –Missing Values-Noisy Data-Inconsistent Data-Data Integration and Transformation- Data Reduction -Dimensionality Reduction – Evaluation criteria of Various Mining Techniques

UNIT IV ASSOCIATION RULE MINING AND CLASSIFICATION **12 Hrs**

Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining Various Kinds of Association Rules – Constraint Based Association Mining – Classification and Prediction - Decision Tree Induction - Entropy and Classification Algorithms -Bayesian Classification – Rule Based Classification

UNIT V CLUSTERING TECHNIQUES **12 Hrs**

Cluster Analysis - Types of Data – Categorization of Major Clustering Methods - Kmeans – Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis –Genetic Algorithm For Mining - Data Mining Applications

Total Hours: 60

TEXT BOOKS:

1. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2012.

REFERENCE BOOKS:

1. Arun K Pujari (2017) Data Mining Techniques 4th edition, Universities Press (India) Ltd.
2. Sam Anahory, Dennis Murry (2004) Data Warehousing in the real world, Pearson Education
3. Margaret H. Dunham (2006) Data Mining: Introductory and Advanced Topics, Pearson

Department of Computer Science and Engineering

Subject Code: BCS21B05	Subject Name : Cyber Security Forensics, Investigation & Laws	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.
- Learn the rights and responsibilities as an employee, team member and a global citizen

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the concepts of Cyber Security
CO2	Analyze the professional practice, law and ethics
CO3	Apply the law and ethics in personal live.
CO4	Study of right and responsibilities as employee, etc.
CO5	Understand the Organizational and Human Security

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	3	2	2	3	3	2	2
CO2	3	3	2	2	2	2	2	2	2	2	1	2
CO3	3	2	1	3	2	1	2	1	2	2	2	2
CO4	2	2	3	2	1	1	1	1	2	1	1	1
CO5	3	3	2	2	2	2	1	2	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	1
CO3	2	2	3	2
CO4	2	3	2	3
CO5	3	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21B05	Cyber Security Forensics, Investigation & Laws	Ty	3	0/0	0/0	3

UNIT- I: Introduction to Computer Security:
Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity.

UNIT-II: Secure System Planning and administration
Introduction to the orange book, Security policy requirements, accountability, assurance and documentation requirements, Network Security, The Red book and Government network evaluations.

UNIT-III: Information security policies and procedures:
Corporate policies- Tier 1, Tier 2 and Tier3 policies – process management-planning and preparation-developing policies-asset classification policy developing standards.

UNIT- IV: Information security: fundamentals
Employee responsibilities- information classification Information handling- Tools of information security- Information processing-secure program administration.

UNIT-V: Organizational and Human Security:
Adoption of Information Security Management Standards, Human Factors in Security- Role of information security professionals.

TOTAL PERIODS: 45

TEXT BOOKS:
Debby Russell and Sr. G. T Gangemi, “Computer Security Basics (Paperback)”, 2nd Edition, O“Reilly Media, 2006
2. Thomas R. Peltier, “Information Security policies and procedures: A Practitioner“s Reference”, 2nd Edition Prentice Hall, 2004.

REFERENCE BOOKS:
1. Kenneth J. Knapp, “Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions”, IGI Global, 2009.
2. Thomas R Peltier, Justin Peltier and John blackley, ”Information Security Fundamentals”, 2nd Edition, Prentice Hall, 1996
3. Jonathan Rosenoer, “Cyber law: the Law of the Internet”, Springer-verlag, 1997
4. James Graham, “Cyber Security Essentials” Averbach Publication T & F Group

Department of Computer Science and Engineering

Subject Code: BCS18011	Subject Name : DOT NET FRAMEWORK	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BIT18I02	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn the concepts of C# Dot Net language and ability to write programs.
- To understand the concepts of VB Dot Net, ADO.NET language and learn to develop an application.
- To develop knowledge to design web based application using ASP.Net.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the concepts of Dotnet framework
CO2	Choose appropriate algorithm for each module considering economic and social aspects
CO3	Construct the simple program with the connectivity of front end and back end.
CO4	Document the approach to be implemented in any language in VB.NET frame work
CO5	Design and apply to the problem solving techniques on real world problems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	1	2	1	3	3	1	3
CO2	3	2	3	3	3	2	2	2	3	3	2	3
CO3	3	3	3	3	3	2	3	2	3	3	3	3
CO4	3	3	3	3	3	2	2	2	3	3	3	3
CO5	3	3	3	3	3	2	3	2	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	3	3	2	3
CO3	3	3	2	3
CO4	3	3	2	3
CO5	3	3	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

					✔							

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18011	**DOT NET FRAMEWORK**	**Ty**	**3**	**1/0**	**0/0**	**4**

UNIT IDOT NET FRAMEWORK **12 Hrs**

.NET platform, .NET Frame work, Common Language Runtime, Namespace, assemblies, .NET memory management Introduction to C#.net, Introduction to VB.NET

UNIT IIC#.NET **12 Hrs**

Introduction to C# , Understanding C# in .NET, Overview of C#, literals, Variables, Data Types. Operators, Expressions, Branching and Looping Operations- Methods, Arrays Strings. Structures and Enumerations – Classes and Objects-inheritance and Polymorphism ,Multiple Inheritance, Operator Overloading, Events, Console I/O Operations and Exception

UNIT III VB.NET **12 Hrs**

Introduction, Windows application, Web application, Building Blocks, programming Fundamentals, Creation of Windows Forms, SDI Vs MDI, Crating run time Windows Controls. File handling, Interaction with other Applications, Creating and using reports, Debugging and Packaging

UNIT IV ADO.NET **12 Hrs**

ADO.NET, Connected Objects, Disconnected Objects, Data Form Wizard, Data Bound Form, Various Connection Methodologies for Database, Querying database, usage of Data Adapter class. Working with data off-line, Data view object, strongly typed Dataset Objects. Working with XML data, Building Windows based and web based application, .Net data providers

UNIT V ASP.NET& WEB SERVICES **12Hrs**

Creation of web services, web service with ASP.NET, ASP.NET applications with databases, cookies and session handling

Total Hours: 60

TEXT BOOKS:

1. ThuanL.Thai, Hoang Lam, (2003).NET Framework Essentials, (3rd ed.) O'reilly Media Inc.
2. Balagurusamy, E. (2010) Programming in C#(3rd ed.) Tata McGraw-Hill

REFERENCE BOOKS:

1. *Kogent Solutions Inc (2009) C# 2008 Programming: Covers .Net 3.5 Black Book, (Platinum ed.) Dreamtech Press*
2. *Kip R Irvine Tony Gaddis (2009) Starting Out with Visual Basic 2008 (4th ed.) Addison Wesleypublication*
3. *Evjen, Hanselman, Rader (2005) Profesional ASP.NET 2.0 , John Wiley & Sons*
4. *David Sceppa (2013) Programming Microsoft ADO.NET4, Amazon.com*
5. *web reference http://msdn.microsoft.com/en-us/vstudio/default.aspx*

Department of Computer Science and Engineering

Subject Code:	Subject Name : MANAGEMENT CONCEPTS AND ORGANIZATIONAL BEHAVIOR	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BMG18002	Prerequisite: BES18ET3 Basic Knowledge such as Statistical Techniques and Probability Theory	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- This course is aimed at addressing the contemporary issues, which fall under the broad title of management, and its functions.
- There will also be an attempt to analyze the behavior of individuals within an organization and the issues of working with other group or teams.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Remember the functions of manager and management
CO2	Able to understand the co workers at work environment
CO3	Apply the enhanced leadership skills
CO4	Understanding and implementing good policies for the welfare of management and workers
CO5	Analyse the behavior of individuals within an organization

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	2	2	3	3	3	3	3	3
CO2	1	3	3	3	1	2	3	3	3	3	3	3
CO3	1	2	3	3	2	2	3	2	3	3	3	3
CO4	2	3	3	3	1	2	3	3	3	3	3	2
CO5	1	2	3	3	3	3	3	3	2	3	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2
CO2	2	2	1	1
CO3	2	1	2	2
CO4	1	2	2	1
CO5	1	2	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Management Science		
										✓		

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BMG18002	**MANAGEMENT CONCEPTS AND ORGANIZATIONAL**	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT I INTRODUCTION TO MANAGEMENT 9 Hrs

Definition of Management – Science or Art or Profession – Manager v_s Entrepreneur vs Leader – Types of Managers – Managerial roles and skills – Evolution of Management – Scientific, Human relations and system approaches

UNIT II PLANNING AND ORGANIZING 9 Hrs

Nature and purpose of planning – planning process – types of planning – planning premises – Nature and purpose of organizing – Formal and Informal organization – organization chart – organization structure – types - Line and staff authority

UNIT III DIRECTING AND CONTROLLING 9 Hrs

Leadership – Types and theories of leadership – communication – process of communication – barriers in communication – System and process of controlling – Budgetary and non budgetary control techniques – Direct and preventive control – reporting

UNIT IV INDIVIDUAL BEHAVIOR 9 Hrs

Diversity - Attitudes and Job satisfaction – Emotions and Moods – personality and values – perception – Decision making – Motivation concepts – Motivation Applications

UNIT V GROUP BEHAVIOR 9 Hrs

Foundations of Group Behavior – Understanding Teams – power and politics – Conflict and Negotiation – Stress Management

Total Hours: 45

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich “Essentials of Management” Tata McGraw Hill Education 2015
2. Stephen. P. Robbins, Timothy A. Judge and Seema Sanghi “Essentials of Organizational Behavior” Pearson 10th Edition 2010

REFERENCE BOOKS:

1. *Tripathi PC & Reddy PN “Priciples of Management” Tata McGraw Hill 2012*
2. *Stephen P. Robbins, David A.De.Cenzo, Mary Coulter “Fundamentals of Management” Pearson Education 2016*

Department of Computer Science and Engineering

Subject Code: BCS18L11	Subject Name : DATA MINING LAB	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BCS18ET3	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Identify and categories the various risks face by an organization;
- Explain the various risk control measures available
- Design a risk management program for a business organization.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Demonstrate the weka tool
CO2	Classify big data analytics domains and collect relevant data for analysis
CO3	Understanding various performance metrics for evaluation of data mining techniques
CO4	Effective Presentation of solutions to problems by choosing appropriate visualization tools
CO5	Create a application from any suitable domain by incorporating all the core concepts

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	3	2	3	2	3	2	3
CO2	3	3	2	3	2	3	2	2	2	3	2	3
CO3	3	3	1	3	2	3	2	2	2	3	2	2
CO4	3	2	3	3	1	2	2	2	2	3	3	2
CO5	3	2	3	3	3	1	1	2	2	3	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2
CO2	2	2	2	2
CO3	2	2	2	2
CO4	3	1	3	3
CO5	3	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✔					

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L11	**DATA MINING LAB**	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Introduction to the Weka machine learning toolkit
2. Classification Introduction to exploratory data analysis using Rattle an open source Tool(R)
3. Introduction to regression using Rattle an open source Tool. (R)
4. Using the Weka toolkit – Part 1
5. the Weka toolkit – Part 2
6. Performing data preprocessing for data mining in Weka
7. Performing clustering in Weka
8. Association rule analysis in Weka
9. Data mining case study using the CRISP-DM standard
10. Data mining case study using the CRISP-DM standard
11. Classification using

Department of Computer Science and Engineering

Subject Code: BCS18L12	Subject Name : DOT NET LAB	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BIT18L08	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn write console application and web based applications in C#.net
- To learn the windows application in VB.net
- To have knowledge to develop web form application ASP.net
- To learn end user application using data base connection using ADO.Net.
- To have knowledge to develop a web service using net frame work.
- To have knowledge to design platform independent application using Dot net framework

OURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the various built in packages and its application in Dot Net
CO2	Demonstrate the interface, multithread concepts and File handling
CO3	Knowledge on designing windows based, web based applications.
CO4	Able to connect frontend and backend using database connectivity.
CO5	Design and develop the distributed applications using Dotnet framework

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	3	1	2	1	3	2	3	3
CO2	2	3	3	3	3	2	2	3	3	3	2	3
CO3	3	3	3	3	3	2	3	2	3	3	3	3
CO4	3	3	3	3	3	2	3	2	3	3	3	3
CO5	3	3	3	3	3	2	3	2	3	3	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	3	2	2	2
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

							✔					

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

BCS18L12	**DOT NET LAB**	Lb	0	0/0	3/0	1

C# .NET

1. Implementation of Operator Overloading
    a. Complex Number
    b. Matrix
    c. Time(+.-)
2. Implementation of Multiple Inheritance
    a. Employee
    b. Area of an Object
3. Implementing Multithreading
4. Exception Handling

VB .NET

5.Designing a Calculator
6. Implement File Handling (Read,Delete,Modify)
7. Implement Exception Handling
    a. Voter problem
    b. Student Status

ASP .NET

8. Super Market
9. Hotel Management System

ADO. NET

10. Student Attendance Calculation
11. Hospital management System

WEB SERVICE

12.Income tax calculation

Department of Computer Science and Engineering

Subject Code: **BCS18L13**	Subject Name : **PROJECT PHASE - I**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	Lb	0	0/0	3/3	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue , address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the knowledge and skills acquired in the course of study, addressing a specific problem or issue.
CO2	Design the software system effectively
CO3	Encourage students to think critically and creatively about societal issues and develop user friendly solution.
CO4	Support the field experience and get linked with the professional network.
CO5	Equip the students with industry knowledge and understanding of various possible technologies.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	3	2	3	2	2	3	2	3	3
CO2	3	3	3	3	3	3	3	2	2	2	3	3
CO3	3	3	3	3	3	3	3	2	2	3	3	3
CO4	3	2	3	3	3	3	2	3	3	3	3	3
CO5	2	2	2	2	2	2	3	2	2	2	1	2

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	3	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	2	2	2	2
CO5	3	2	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✔					

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L13	**PROJECT PHASE – I**	**Lb**	**0**	**0/0**	**3/3**	**2**

B.Tech CSE Project carries 12 credits of which , Phase I carries 2 credit.

In Phase I ,Students are expected to

i. Identify a Problem.
ii. Have the feasibility explored.
iii. Freeze the Requirement specification (both user and system).
iv. Construct the architectural model (as many as required).
v. Design the solution.
vi. If possible publish the Feasibilty study as a survey paper

Department of Computer Science and Engineering

Subject Code: **BHS18FLX**	Subject Name : **FOREIGN LANGUAGE (EVALUATION)**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: NIL	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : To recognize the cultural values, practices, and heritage of the foreign country, communicate effectively in a foreign language and interact in a culturally appropriate manner with native speakers of that language.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Achieve functional proficiency in listening, speaking, reading, and writing.
CO2	Develop an insight into the nature of language itself, the process of language and culture acquisition.
CO3	Decode, analyze, and interpret authentic texts of different genres.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**3**	**2**	**3**	**3**	**1**
CO2	**2**	**1**	**1**	**1**	**1**	**3**	**1**	**3**	**3**	**3**	**3**	**1**
CO3	**1**	**1**	**2**	**2**	**1**	**3**	**2**	**3**	**2**	**3**	**3**	**1**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**1**	**1**	**1**	**1**
CO2	**1**	**1**	**1**	**1**
CO3	**1**	**2**	**2**	**1**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

			✓								

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BHS18FLX	**FOREIGN LANGUAGE (EVALUATION)**	Lb	0	0/0	3/0	1

OBJECTIVE :

To recognize the cultural values, practices, and heritage of the foreign country, communicate effectively in a foreign language and interact in a culturally appropriate manner with native speakers of that language

Department of Computer Science and Engineering

SEMESTER - VIII

Subject Code: **BCS18012**	Subject Name : **OPEN SOURCE SCRIPTING LANGUAGES**	**Ty/ Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: BCS18ET3	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- The students will have knowledge about the scripting languages
- To learn the JavaScript language and ability to write program on it.
- To learn the PERL language and ability to write program on it.
- To study about the Python language and understand to write basic level program and advance program on networking, web scripting on web pages.
- To study about RUBY language and have knowledge to write programs.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Remember the concepts of basic structure of the program
CO2	Understand the basic programming concepts of OOSL based on their knowledge
CO3	Interpret and efficient solutions for problem based on OOSL
CO4	Differentiate the problem based on OOSL and provide efficient solutions.
CO5	Build to develop an application using scripting languages.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**2**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO5	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**2**	**2**	**2**
CO2	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**3**	**2**	**2**	**2**
CO5	**3**	**3**	**2**	**3**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✔								

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18012	OPEN SOURCE SCRIPTING LANGUAGES	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO SCRIPTING LANGUAGES 8 Hrs

Introduction to Scripting: Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Uses for Scripting Languages, Web Scripting, and the universe of Scripting Languages.

UNIT II JAVASCRIPT 9 Hrs

JavaScript introduction – control structures – functions – arrays – document objects model – Event handling – object oriented in JavaScript - simple web applications

UNIT III PERL 9 Hrs

PERL- Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.Finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

UNIT IV PYTHON 10 Hrs

Python: Installing Python,Introduction to Python language, Basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables-operators and expressions - Conditions and Control statements – String handling, files and directories - functions and its types.Simple Graphics and Image Processing, Python with OOP - Exception handling

UNIT V RUBY 9 Hrs

Introduction to RUBY : Basics, Comments, Variables Strings, Operators, Conditional Statements,Arrays and Hashes, Methods Files,classes, Exception Handling Introduction to Ruby on Rail .

Total Hours: 45

TEXT BOOKS:

1. David Barron, “The World of Scripting Languages” , Wiley Publications,2002
2. Kenneth A. Lambert, Martin Osborne, “Fundamentals ofPython: First Programs”, Contributing Author published by Course Technology, Cengage Learning Publications.2010.
3. Michael Fitzgerald, “Learning Ruby”, O’Reilly Publications, 2007.

REFERENCE BOOKS:

1. *Richard Clark, Oli Studholme, Christopher Murphy and Divya Manian,”Beginning HTML5 and CSS 3” @ Apress.*
2. *Jennifer Campbell , Paul Gries, Jason Montojo , Greg Wilson , “Practical Programming An Introduction to Computer Science Using Python” , The Pragmatic Bookshelf Raleigh, North Carolina Dallas, Texas , 2009*
3. *Tom Christiansen, brian d foy & Larry Wall, with Jon Orwant, “Programming Perl, Fourth Edition “, O’Reilly, 2012.*

Department of Computer Science and Engineering

Subject Code: BCS18L14	Subject Name : PROJECT (PHASE – II)	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: BCS18L13	Lb	0	0/0	12/12	8

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue , address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	To explain the functionality of the system
CO2	To express proficiency in handling the technologies
CO3	To support the societal problems
CO4	To summarize the innovative ideas with good documentation
CO5	To validate the implementation of the software/Hardware system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	3	1	2	2	3	3
CO2	3	3	3	3	3	3	3	2	2	2	3	3
CO3	3	3	3	3	3	3	3	2	2	3	3	3
CO4	3	2	3	3	3	3	2	3	3	3	3	3
CO5	1	2	2	2	2	2	3	2	2	2	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	2	2	2	2
CO5	3	2	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✔					

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL	L	T/ S.Lr	P/R	C
BCS18L14	**PROJECT (PHASE – II)**	**Lb**	**0**	**0/0**	**12/12**	**8**

Students are expected to carry out the following :

(i) Implement the Design using suitable technologies.

(ii) Generate the test cases.

(iii) Demonstrate the solution with suitable user interface.

(iv) Prepare a project report consolidating the phase-I and II activities.

Subject Code: **BCS21BE01**	Subject Name : Deep Learning	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To Recognize the characteristics of deep learning models that are useful to solve real-world problems.
- To Understand different methodologies to create application-specific Deep Neural Networks
- To Identify and apply appropriate deep learning algorithms for analyzing the data for variety of problems.
- To Generate the generative models for unsupervised learning task and choose appropriate models for real world problems.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the characteristics of deep learning models
CO2	Understand the methodologies to create applications on Deep Neural N/W
CO3	Apply appropriate deep learning algorithms for analyzing the data for variety of problems.
CO4	Understand the generative models for unsupervised learning task
CO5	Apply the appropriate models for real world problems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**3**	**2**
CO2	**3**	**3**	**2**	**3**	**1**	**3**	**2**	**2**	**2**	**1**	**1**	**2**
CO3	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**
CO4	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**1**

Department of Computer Science and Engineering

CO5	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**1**	**1**	**2**	**2**	**1**
COs / PSOs	**PSO1**			**PSO2**			**PSO3**			**PSO4**		
CO1	**3**			**3**			**2**			**2**		
CO2	**2**			**2**			**1**			**1**		
CO3	**2**			**2**			**2**			**2**		
CO4	**3**			**1**			**2**			**1**		
CO5	**2**			**2**			**1**			**1**		
3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low												

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE01	Deep Learning	Ty	3	0/0	0/0	3

Unit – I Machine Learning Basics and Deep Learning & Architectures:

Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality.Machine Learning Vs. Deep Learning, Representation Learning, Width Vs. Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Regularization- dropout, drop connect, optimization methods for neural networks- Adagrad, adadelta, rmsprop, adam, NAG.

Unit- II Convolution Neural Networks

Architectural Overview – Motivation - Layers – Filters – Parameter sharing – Regularization, Popular CNN Architectures: LeNet, ResNet, Vggnet, AlexNet. Transfer learning Techniques - DenseNet, PixelNet. Deep Learning Hardware and Software - CPUs, GPUs, TPUs, PyTorch, TensorFlow, Dynamic vs Static computation graphs, Data Preprocessing-Data Augmentation, batch normalization,

Unit – III Transfer Learning and Sequence Modeling Recurrent and Recursive Nets

Transfer Learning- Deep Transfer Learning Strategies, Update rules, hyper parameter tuning, Learning rate scheduling, variants of CNN- ResNet, GoogleNet, Xception, etc Recurrent Neural Networks, Bidirectional RNNs – Encoder-decoder sequence to sequence architectures - Back propagation Through Time for training RNN, Long Short Term Memory Networks.

Unit –IV Auto Encoders

Under complete Autoencoders, Regulraized Autoencoders, Sparse Autoencoders, Denoising Autoencoders, Representational Power, Layer, Size, and Depth of Autoencoders, Stochastic Encoders and Decoders – Contractive Encoders.

Unit – V Deep Generative Models

Deep Belief networks – Boltzmann Machines – Deep Boltzmann Machine - Generative Adversial Networks, Recent Trends

Text Books:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, " Deep Learning", MIT Press, 2017.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017

Reference Books:

1. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.

2. Ethem Alpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.

3. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.

Department of Computer Science and Engineering

Subject Code: **BCS21BE02**	Subject Name : Privacy and Security in IOT	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Identify the areas of cyber security for the Internet of Things.
- Assess different Internet of Things technologies and their applications.
- Model IoT to business
- Customize real time data for IoT applications.
- Solve IoT security problems using light weight cryptography
- Build security systems using elementary blocks

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the different IOT technologies and its applications
CO2	Apply IOT to Business
CO3	Analyze real time data for IOT Applications
CO4	Evaluate IOT Security Problems
CO5	Develop Security system using blocks.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**
CO2	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**
CO3	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**1**
CO4	**2**	**2**	**3**	**1**	**1**	**2**	**2**	**2**	**2**	**1**	**1**	**2**
CO5	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**3**	**3**	**2**	**2**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**3**	**3**	**2**
CO2	**1**	**3**	**3**	**2**
CO3	**2**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**1**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE02	Privacy and Security in IOT	Ty	3	0/0	0/0	3

Unit-I Introduction to IoT –Cyber Physical Systems

IoT and cyber-physical systems, IoT security (vulnerabilities, attacks, and countermeasures), security engineering for IoT development, IoT security lifecycle. IoT as Interconnection of Threats 5 hours Network Robustness of Internet of Things- Sybil Attack Detection in Vehicular Networks- Malware Propagation and Control in Internet of Things- Solution-Based Analysis of Attack Vectors on Smart Home Systems

Unit-II Crypto Foundations and Block Chains

Block ciphers, message integrity, authenticated encryption, hash functions, Merkle trees, elliptic curves, and public-key crypto (PKI), and signature algorithms. Crypto-currencies, Bitcoin P2P network, distributed consensus, incentives and proof-of-work, mining, script and smart contracts, wallets: hot and cold storage, anonymity, altcoins.

Unit-III Privacy Preservation for IoT

Privacy Preservation Data Dissemination- Privacy Preservation Data Dissemination- Social Features for Location Privacy Enhancement in Internet of Vehicles- Lightweight and Robust Schemes for Privacy Protection in Key Personal IoT Applications: Mobile WBSN and Participatory Sensing

Unit-IV Trust Models for IoT

Authentication in IoT- Computational Security for the IoT- Privacy-Preserving Time Series Data Aggregation- Secure Path Generation Scheme for Real-Time Green Internet of Things- Security Protocols for IoT Access Networks- Framework for Privacy and Trust in IoT- Policy-Based Approach for Informed Consent in Internet of Things.

Unit-V Internet of Things Security

Security and Impact of the Internet of Things (IoT) on Mobile Networks- Networking Function Security-IoT Networking Protocols, Secure IoT Lower Layers, Secure IoT Higher

Layers, Secure Communication Links in IoTs, Back-end Security -Secure Resource Management, Secure IoT Databases, Security Products-Existing Test bed on Security and Privacy of IoTs, Commercialized Products.

Total Lecture hours: 45 hours

Text Book(s)

1. Hu, Fei. Security and privacy in Internet of things (IoTs): Models, Algorithms, and Implementations, 1st edition,CRC Press, 2016.

2.Russell, Brian, and Drew Van Duren. Practical Internet of Things Security, 1st edition, Packt Publishing Ltd, 2016.

Reference Books

1. . Whitehouse O. Security of things: An implementers' guide to cyber-security for internet of things devices and beyond, 1st edition, NCC Group, 2014

2. DaCosta, Francis, and Byron Henderson. Rethinking the Internet of Things: a scalable approach to connecting everything, 1st edition, Springer Nature, 2013.

Department of Computer Science and Engineering

Subject Code: **BCS21BE03**	Subject Name : Ethical Hacking	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Information security governance, and related legal and regulatory issues Learn various hacking methods and perform system security
- Vulnerability testing. Perform system vulnerability exploit
- Learn various issues related to hacking.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the Information security related legal an regularity issues
CO2	Analyze various hacking methods
CO3	Analyze Vulnerability testing
CO4	Understand system vulnerability
CO5	Study of various issues related to hacking

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO2	**3**	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**2**
CO3	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**1**	**2**	**3**	**2**	**2**
CO4	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**2**	**2**	**1**	**2**	**2**
CO5	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**2**	**3**
CO2	**2**	**3**	**3**	**2**
CO3	**2**	**3**	**2**	**3**
CO4	**3**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE03	Ethical Hacking	Ty	3	0/0	0/0	3

UNIT-I: ATTACKS

Introduction Security mindset, Computer Security Concepts (CIA), Threats, Attacks, and Assets, Software Security: Vulnerabilities and protections, malware, program analysis.

UNIT II: NETWORK SECURITY:

Network security issues, Sniffing, IP spoofing, Common threats, E-Mail security, IPSec, SSL, PGP, Intruders, Virus, Worms, Firewalls-need and features of firewall, Types of firewall, Intruder Detection Systems.

UNIT III: HACKING WINDOWS

BIOS Passwords, Windows Login Passwords, Changing Windows Visuals, Cleaning Your Tracks, Internet Explorer Users, Cookies, URL Address Bar, Netscape Communicator, Cookies, URL History, The Registry, Baby Sitter Programs

UNIT IV: ADVANCED WINDOWS HACKING

Editing your Operating Systems by editing Explorer.exe, The Registry, The Registry Editor, Description of .reg file, Command Line Registry Arguments, Other System Files, Some Windows & DOS Tricks, Customize DOS, Clearing the CMOS without opening your PC, The Untold Windows Tips and Tricks Manual, Exiting Windows

the Cool and Quick Way, Ban Shutdowns: A Trick to Play, Disabling Display of Drives in My Computer, Take Over the Screen Saver, Pop a Banner each time Windows Boots, Change the Default Locations, Secure your Desktop Icons and Settings.

UNIT V GETTING PAST THE PASSWORD PASSWORDS:

An Introduction, Password Cracking, Cracking the Windows Login Password, The Glide Code, Windows Screen Saver Password, XOR, Internet Connection Password, Sam Attacks,

Cracking Unix Password Files, HTTP Basic Authentication, BIOS Passwords, Cracking Other Passwords. TOTAL PERIODS: 60

Text Books: 1.

William Stallings; Lawrie Brown “Computer Security: Principles and Practice”, 4TH Edition 2018 Pearson Education.

2. Patrick Engbreston: “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy”,1st Edition, Syngress publication,2011.

3. Ankit Fadia : “Unofficial Guide to Ethical Hacking”, 3rd Edition , McMillan India Ltd,2006.

Reference Books:

1. Buchmann J. A., Introduction to Cryptography, Springer Verlag (2001).

2. Stallings William, Cryptography and Network Security, Pearson Education (2006).

3.Simpson/backman/corley, “Hands On Ethical Hacking & Network Defense International”, 2nd Edition, Cengageint, 2011
Content

Department of Computer Science and Engineering

Subject Code:	Subject Name : Vulnerability Analysis and Penetration Testing	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE04	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Ability to determine the security threats and vulnerabilities in computer networks using penetration testing techniques
- Set up of a hacking lab environment to study and document vulnerabilities within the network
- Realize and respect ethical boundaries to demonstrate and understand what is necessary and appropriate when conducting penetration tests

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the Security threats
CO2	Evaluate Vulnerabilities in computer networks using penetration testing
CO3	Design hacking lab environment to study vulnerabilities
CO4	Analyze ethical boundaries
CO5	Understand the penetration testing

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	2	3	3	2	2	2	3
CO2	3	3	3	2	2	2	2	2	2	2	2	2
CO3	3	2	3	2	1	1	3	2	1	2	1	2
CO4	3	2	2	1	1	2	2	2	2	2	2	1
CO5	3	2	1	2	2	3	2	1	1	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3
CO2	1	2	2	2
CO3	2	3	2	2
CO4	2	2	3	2
CO5	2	3	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE04	Vulnerability Analysis and Penetration Testing	Ty	3	0/0	0/0	3

UNIT-I INFORMATION GATHERING AND DETECTING VULNERABILITIES

Open Source Intelligence Gathering - Port Scanning - Nessus Policies - Web Application Scanning Manual Analysis- Traffic Capturing Password Attacks Client side Exploitation Social Engineering- Bypassing Antivirus Applications.

UNIT-II EXPLOITS AND WIRELESS SECURITY

Metasploit Payloads Open phpMyAdmin -Buffer overflow: Windows and Linux,Web scanning exploits, port scanning exploits, SQL exploits Wired vs. wireless Privacy Protocols Wireless Frame Generation Encryption Cracking Tools- Wireless DoS Attacks

UNIT –III COMMON VULNERABILITY ANALYSIS OF APPLICATION PROTOCOLS

Simple Mail Transfer Protocol- File Transfer Protocol- Trivial File Transfer Protocol-Hyper Text Transmission Protocol-ICMP SMURF- UDP-DNS-PING-SYN

UNIT-IV NETWORK VULNERABILITY ANALYSIS

Domain Name Server and Dynamic Host Configuration Protocol -Light Weight Directory Access Protocol-Simple Network Management Protocol-Remote Procedural Call

Department of Computer Science and Engineering

UNIT-V PENETRATION TOOLS AND DATABASE SECURITY

Traceroutes, Neotrace, Whatweb. Database Security: Access control in database systems - Inference control - Multilevel database security Recent Trends

Total Lecture hours: 45 hours

Text Book(s)

1. Georgia Weidman, ”Penetration Testing: A Hands On Introduction to Hacking”, No Startch Press, First Edition 2014. ISBN-13: 978-1593275648 ISBN-10: 1593275641.
2. B.Singh, H.Joseph and Abhishek Singh,”Vulnerability Analysis and Defense for the Internet, Springer, 2008 Edition. ISBN-10: 0387743898 ISBN-13: 978-0387743899.

Reference Books

1. Rafay Baloch, ”Ethical Hacking and Penetration Testing Guide”,CRC Press, 2015,ISBN :78-1-4822-3161-8.

2. Dr.Patrick Engebretson, ”The Basics of Hacking and Penetration Testing”,Syngress Publications Elseveir, 2013, ISBN : 978-0-12-411644-3

3. Prakhar Prasad, Mastering Modern Web Penetration Testing (Kindle Edition),2016 , Packt Publishing, ISBN:978-1-78528-458-8.

4 Gilberto Najera Gutierrez, Kali Linux Web Penetration Testing Cookbook ,2016, ISBN13 9781784392918

5 Robert Svensson, From Hacking to Report Writing: An Introduction to Security and Penetration Testing 2016, ISBN 978-1-4842-2282-9 Mode

Department of Computer Science and Engineering

Subject Code:	Subject Name : Design and Development of Block Chain Applications	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE05	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To Understand emerging abstract models for Blockchain Technology.
- To Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
- To provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
- Understand hyperledger Fabric and Etherum platform to implement the Block chain Application.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand emerging models for block chain technology
CO2	Understand the research challenges and gaps between theory and practice
CO3	Analyze the function of block chain method
CO4	Evaluate the new applications
CO5	Apply hyper ledger Fabric and Etherum platform to implement the Block chain Application.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	3	2	2	3	2	3	2
CO2	3	3	3	1	3	2	3	3	2	3	2	2
CO3	3	2	3	2	2	3	2	3	2	2	2	1
CO4	3	2	2	3	2	3	2	2	2	2	3	2
CO5	3	2	2	2	1	2	1	2	2	3	2	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3
CO2	3	3	2	2
CO3	2	1	3	2
CO4	3	2	2	3
CO5	2	2	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE02	Design and Development of Block Chain Applications	Ty	3	0/0	0/0	3

UNIT – I INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT – II BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network (6)

UNIT – III BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem-Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environmentPaxos (12)

UNIT – IV DISTRIBUTED CONSENSUS

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance (10)

Department of Computer Science and Engineering

UNIT – V HYPER LEDGER FABRIC & ETHERUM

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, TruffleDesign and issue Crypto currency, Mining, DApps, DAO Blockchain Applications Internet of Things-Medical Record Management System-Blockchain in Government and Blockchain Security-Blockchain Use Cases –Finance

TOTAL: 45

TEXTBOOK:

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017.

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.

Department of Computer Science and Engineering

Subject Code: BCS21BE06	Subject Name : CYBER SECURITY	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Know the fundamental mathematical concepts related to security.
- Implement the cryptographic techniques to real time applications.
- Comprehend the authenticated process and integrity, and its implementation
- Know fundamentals of cybercrimes and the cyber offenses.
- Exploring the industry practices and tools to be on par with the recent trends

COURSE OUTCOMES (COs) : (3- 5)	
CO1	Understand the fundamental mathematical concepts related to security.
CO2	Apply the cryptographic techniques to real time applications.
CO3	Understand the fundamentals of cybercrimes and the cyber offenses.
CO4	Analyze the cyber threats, attacks, vulnerabilities and its defensive mechanism.
CO5	Design suitable security policies for the given requirements.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	2	2	3	3	2	2	1
CO2	3	3	2	3	1	3	2	2	2	1	1	2
CO3	3	2	3	2	3	1	3	1	2	2	2	1
CO4	2	2	2	3	2	2	1	2	1	2	1	2
CO5	3	3	3	2	1	2	2	2	2	1	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	1	2	2	3
CO3	2	3	3	2
CO4	2	2	2	3
CO5	2	1	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE06	CYBER SECURITY	Ty	3	0/0	0/0	3

UNIT- I Introduction to Number Theory and Cryptographic Techniques

Finite Fields and Number Theory: Modular arithmetic, Euclidian Algorithm, Primality Testing: Fermats and Eulers theorem, Chinese Reminder theorem, Discrete Logarithms

Symmetric key cryptographic techniques: Introduction to Stream cipher, Block cipher: DES, AES,IDEA Asymmetric key cryptographic techniques: principles,RSA,ElGamal,Elliptic Curve cryptography, Key distribution and Key exchange protocols.

UNIT-II INTEGRITY AND AUTHENTICATION

Hash functions, Secure Hash Algorithm (SHA)Message Authentication, Message Authentica- tion Code (MAC), Digital Signature Algorithm : RSA ElGamal based

UNIT-III CYBERCRIMES AND CYBER OFFENSES

Classification of cybercrimes, planning of attacks, social engineering: Human based, Computer based: Cyber stalking, Cybercafe and Cybercrimes

UNIT-IV CYBER THREATS, ATTACKS AND PREVENTION

Phishing, Password cracking, Keyloggers and Spywares, DoS and DDoS attacks, SQL Injection Identity Theft (ID) : Types of identity theft, Techniques of ID theft

UNIT-V CYBERSECURITY POLICIES AND PRACTICES

What security policies are: determining the policy needs, writing security policies, Internet and email security policies, Compliance and Enforcement of policies, Review Recent Trends Industry Expert talk

Total Lecture hours: 45 hours

Text Book(s)

1. Cryptography and Network security, William Stallings, Pearson Education, 7th Edition, 2016
2. Cyber Security, Understanding cyber crimes, computer forensics and legal perspectives, Nina Godbole,Sunit Belapure, Wiley Publications, Reprint 2016
3. Writing Information Security Policies, Scott Barman, New Riders Publications, 2002

Reference Books

1. Cybersecurity for Dummies, Brian Underdahl, Wiley, 2011 2. Cryptography and Network security, Behrouz A. Forouzan , Debdeep Mukhopadhyay, Mcgraw Hill Education, 2 nd Edition, 2011

Department of Computer Science and Engineering

Subject Code: BCS21BE07	Subject Name : Information Security Analysis and Audit	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To Contribute to managing information security ·
- TO Install and configure information security devices ·
- To Maintain a healthy, safe and secure working environment ·
- To Provide data/information in standard formats ·
- To Develop their knowledge, skills and competence

COURSE OUTCOMES (COs) : (3- 5)

CO1	Analyze the information security ·
CO2	Understand the information security devices ·
CO3	Analyze healthy, safe and secure working environment ·
CO4	Apply the data/information in standard formats ·
CO5	Design and Develop their knowledge, skills and competence

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	2	3	2	2	2	2
CO2	3	2	2	3	2	3	2	2	3	2	2	2
CO3	3	3	3	2	3	2	2	2	2	1	2	1
CO4	3	3	2	2	2	1	2	1	1	2	1	2
CO5	3	2	2	2	1	2	1	2	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2
CO2	1	3	3	2
CO3	2	2	2	3
CO4	3	2	3	2
CO5	2	3	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE07	Information Security Analysis and Audit	Ty	3	0/0	0/0	3

UNIT - I INFORMATION SECURITY FUNDAMENTALS

Definitions & challenges of security, Attacks & services, Security policies, Security Controls, Access control structures, Cryptography, Deception, Ethical Hacking, Firewalls, Identify and Access Management (IdAM System Security System Vulnerabilities, Network Security Systems, System Security, System Security Tools, Web Security, Application Security, Intrusion Detection Systems.

UNIT - I I INFORMATION SECURITY MANAGEMENT

Monitor systems and apply controls, security assessment using automated tools, backups of security devices, Performance Analysis, Root cause analysis and Resolution, Information Security Policies, Procedures, Standards and Guidelines Incident Management Security requirements, Risk Management, Risk Assessment, Security incident management, third party security management, Incident Components, Roles.

UNIT – III INCIDENT RESPONSE AND CONDUCTING SECURITY AUDITS

Incident Response Lifecycle, Record, classify and prioritize information security incidents using standard templates and tools, Responses to information security incidents, Vulnerability Assessment, Incident Analysis. Common issues in audit tasks and how to deal with these, Different systems and structures that may need information security audits and how they operate, including: servers and storage devices, infrastructure and networks, application hosting and content management, communication routes such as messaging,

UNIT - IV INFORMATION SECURITY AUDIT PREPARATION

Establish the nature and scope of information security audits, Roles and responsibilities, Identify the procedures/guidelines/checklists, Identify the requirements of information security, audits and prepare for audits in advance, Liaise with appropriate people to gather data/information required for information security audits.

UNIT - V SELF AND WORK MANAGEMENT

Establish and agree work requirements with appropriate people, Keep the immediate work area clean and tidy, utilize time effectively, Use resources correctly and efficiently, Treat confidential information correctly, Work in line with organization's policies and procedures, Work within the limits of their job role.

Total Lecture hours: 30 hours

Text Book:

1. William Stallings, Lawrie Brown, Computer Security: Principles and Practice, 3rd edition, 2014.

2. Nina Godbole, Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, Wiley, 2017

3. Nina Godbole, Sunit Belapure, Cyber Security- Understanding cyber-crimes, computer forensics and legal perspectives, Wiley Publications, 2016 Andrew Vladimirov Michajlowski, Konstantin, Andrew A. Vladimirov, Konstantin V. Gavrilenko,

4. Assessing Information Security: Strategies, Tactics, Logic and Framework, IT Governance Ltd, O'Reilly, 2010

Reference Books :

1. Charles P. Pfleeger, Security in Computing, 4th Edition, Pearson, 2009.

2. Christopher J. Alberts, Audrey J. Dorofee , Managing Information Security Risks, Addison-Wesley Professional, 2004

3. Peter Zor, The Art of Computer Virus Research and Defense, Pearson Education Ltd, 2005

4. Lee Allen, Kevin Cardwell, Advanced Penetration Testing for Highly-Secured Environments - Second Edition, PACKT Publishers, 2016 Chuck Easttom ,

System Forensics Investigation and Response, Second Edition, Jones & Bartlett 5. Learning, 2014 David Kennedy, Jim O'Gorman, Devon Kearn

Department of Computer Science and Engineering

Subject Code: BCS21BE08	Subject Name : INDUSTRIAL AND MEDICAL IoT	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To Develop conceptual design of Medical and Industrial IoT architecture.
- To Apply sensors and various protocols for industry standard solutions
- To Articulate privacy and security measures for industry standard solutions.
- To Study about Internet of Medical Things (IoMT) and its applications in Healthcare industry.
- To Design various applications using IoT in Healthcare Technologies.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the conceptual design of medical & Industrial IoT
CO2	Apply sensors and protocols for industry standard
CO3	Analyze the security measures
CO4	Understand IOMT and its applications
CO5	Design various applications using IOT

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	2	3	2	2	3	2	2
CO2	3	2	2	3	2	2	2	2	1	2	2	2
CO3	3	3	1	2	2	1	2	2	2	2	2	2
CO4	3	3	2	2	1	2	2	1	2	2	1	1
CO5	3	2	1	1	2	1	1	2	1	2	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2
CO2	2	3	3	2
CO3	1	2	2	2
CO4	3	2	2	2
CO5	2	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE08	INDUSTRIAL AND MEDICAL IoT	Ty	3	0/0	0/0	3

UNIT-I INDUSTRIAL IOT INTRODUCTION ON

Introduction to IOT, What is IOT? IOT Vs. IIOT, History of IIOT, Components of IIOT - Sensors, Interface, Networks, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT

UNIT-II IOT ARCHITECTURE IOT COMPONENTS

Various Architectures of IOT and IIOT, Advantages & disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IOT

UNIT-III SENSORS AND PROTOCOLS

Introduction to sensors, Roles of sensors in IIOT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Need of protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, Bacnet, BLE, Modbus, SPI , I2C, IIOT protocols – COAP, MQTT, 6lowpan, lwm2m, AMPQ. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet.

UNIT-IV PRIVACY AND SECURITY

Introduction to web security, Conventional web technology and relationship with IIOT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability

UNIT-V IOMT INTRODUCTION AND HEALTHCARE TECHNOLOGIES

What are IoMT and its working? Tracking assets and resources, Internet of things in hospitals, collection and integration of clinical data, Major benefits of IoT in healthcare, Disadvantages of IoT in healthcare. Home Monitoring System for Aged Care, Smart Medicinal Packages for Medication Adherence, Smart Drug Delivery System for Automated Drug Dispensation, Connected Rural Healthcare Consultation, Population and Environment Monitoring of Infectious Diseases

Total Lecture hours: 45 hours

Text Book(s)

1. Veneri, Giacomo, and Antonio Capasso. Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1st edition, Packt Publishing Ltd, 2018.

2.Reis, Catarina I., and Marisa da Silva Maximiano, eds. Internet of Things and advanced application in healthcare, 1st edition, IGI Global, 2016.

Reference Books

1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st Edition, Apress, 2017

2.Aboul Ella Hassanien, Nilanjan Dey and Sureaka Boara, Medical Big Data and Internet of Medical Things: Advances, Challenges and Applications, 1st edition, CRC Press, 2019.

Department of Computer Science and Engineering

Subject Code:	Subject Name :	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE09	Cyber Security Risk Management And Mitigation					
	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study security environment
- To understand the security threats
- To analyze the strategy for planning
- To design risk management
- To understand the security awareness

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the principles of cyber security
CO2	Analyze the security threats
CO3	Apply the strategic planning
CO4	Analyze the risk management
CO5	Study the security awareness

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	3	2	2	2	2	3	2
CO2	2	3	2	2	2	2	1	2	2	3	3	2
CO3	2	2	1	2	2	2	2	2	1	2	2	3
CO4	3	2	2	1	2	2	1	1	2	2	3	2
CO5	2	2	1	2	2	2	2	2	2	3	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	2	2	2	1
CO3	2	1	3	2
CO4	2	3	3	2
CO5	3	3	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

Department of Computer Science and Engineering

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE09	Cyber Security Risk Management And Mitigation	Ty	3	0/0	0/0	3

UNIT- I INTRODUCTIO NTO CYBERSECURI TY

The Security Environment: Threats, vulnerabilities, and consequences - Advanced persistent threats -The state of security today. Principles of Cyber security: The interrelated components of the computing environment – Cyber security models - Variations on a theme: computer security, information security, and information assurance. Cyber security Management Concepts: Management models, roles, and functions. Enterprise Roles and Structures: Information security roles and positions.

UNIT -II STRATEGIC PLANNING AND SECURITY PLANS

Strategy and Strategic Planning: Strategy - Strategic planning and security strategy - The information security lifecycle - Architecting the enterprise. Security Plans and Policies: Levels of planning , Planning misalignment - The System Security Plan (SSP)- Policy development and implementation. Security Standards and Controls: Security standards and controls - Certification and accreditation (C&A).

UNIT - III RISK MANAGEMENT

Risk Management: Principles of risk - Types of risk - Risk strategies - The Risk Management Framework (RMF). Physical Security and Environmental Events: Physical and environmental threats Physical and environmental controls. Contingency Planning: Developing a contingency plan Understanding the different types of contingency plan - Responding to events.

UNIT IV SECURITY AWARENESS

Security Education, Training, and Awareness: Human factors in security - Developing and implementing a security training plan - Cross-domain training (IT and other security domains). The future of cyber security: Key future uncertainties - Possible future scenarios - How to apply what you've learned.

UNIT V CASE STUDY

Case Study on Pune Citibank MphasiS Call Center Fraud – The Bank NSP Case – UTI Bank hooked in a phishing attack – Mumbai Police can now nail web offenders – Orkut: The new danger.

Total: 45 Hours

Books for References:

1. Rhodes-Ousley, Mark. “Information Security: The Complete Reference, Second Edition, .

Information Security Management: Concepts and Practice”, New York, McGraw-Hill, 2013.

2. Whitman, Michael E. and Herbert J. Mattord, “ Roadmap to Information Security for IT and

Infosec Managers”, Boston, MA: Course Technology, 2011.

3. Michael E. Whitman and Herbert J. Mattord, “Principles of Information Security”, Course

Technology, Cengage Learning, Fourth Edition, Nov, 2014.

Web Resources:

1. file:///C:/Users/admin/Desktop/Online%20work/Course/Risk%20management%20in%20Cyber

%20Security/Whitman.pdf

2. https://www.cyberralegalservices.com/detail-casestudies.php.

3. https://rtinagpur.cag.gov.in/uploads/CaseStudies/CaseStudiesonCyberCrimesNOTSENT/CaseSt

udiesonCyberCrimes.pdf.

Department of Computer Science and Engineering

Subject Code: **BCS21BE10**	Subject Name : IOT ENABLED SYSTEM DESIGN	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

-

COURSE OUTCOMES (COs) : (3- 5)

CO1	Articulate the main concepts, key technologies, strength and limitations of IoT.
CO2	Identify the architecture, infrastructure models of IoT.
CO3	Analyze the networking and how the sensors are communicated in IoT .
CO4	Analyze and design different models for IoTimplemention.
CO5	Identify and design the new models for market strategic interaction.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	3	3	3	2	2	3	2	2	2
CO2	2	2	2	2	3	1	2	3	2	2	2	2
CO3	3	3	2	2	2	2	2	2	3	2	3	1
CO4	3	2	3	1	2	2	1	2	2	1	2	2
CO5	2	2	3	2	2	3	2	1	2	2	1	2

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	3	2
CO2	1	3	3	2
CO3	2	3	3	3
CO4	3	2	3	2
CO5	2	3	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE10	IOT ENABLED SYSTEM DESIGN	Ty	3	0/0	0/0	3

UNIT- I INTRODUCTION TO INTERNET OF THINGS

Rise of the machines – Evolution of IoT – Web 3.0 view of IoT – Definition and characteristics of IoT – IoT Enabling Technologies – IoT Architecture -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects - IoT levels and deployment templates – A panaromic view of IoT applications.

UNIT- II MIDDLEWARE AND PROTOCOLS OF IOT

Middleware technologies for IoT system (IoT Ecosystem Overview – Horizontal Architecture Approach for IoT Systems – SOA based IoT Middleware) Middleware architecture of RFID,WSN,SCADA,M2M –Interoperability challenges of IoT- Protocols for RFID,WSN,SCADA,M2M- Zombie, KNX,BACNet,MODBUS - Challenges Introduced by 5G in IoT Middleware(Technological Requirements of 5G Systems - Perspectives and a Middleware Approach Toward 5G (COMPaaS Middleware) – Resource management in IoT. 109

UNIT- III COMMUNICATION AND NETWORKING

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition –Application Layer Protocols: CoAP and MQTT- Data aggregation & dissemination.

UNIT- IV IOT IMPLEMENTATION TOOLS

Introduction to Python, Introduction to different IoTtools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python, Implementation of IoT with Raspberry Pi.

UNIT- V APPLICATIONS AND CASE STUDIES

Home automations - Smart cities – Environment – Energy – Retail – Logistics – Agriculture – Industry - Health and life style – Case study.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Honbo Zhou, “Internet of Things in the cloud:A middleware perspective”, CRC press, 2012.

2. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-onApproach)”, VPT, 1 st Edition, 2014.

REFERENCES:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.

2. Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, “Internet of Things (IoT) in 5G Mobile Technologies” Springer International Publishing Switzerland 2016.

3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things” Springer-Verlag Berlin Heidelberg, 2011.

Department of Computer Science and Engineering

Subject Code: **BCS21BE11**	Subject Name : PROGRAMMING FOR IOT BOARDS	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To Investigate various challenges in designing IoT devices
- To Use open source hardware prototyping platform for building digital devices and interactive To objects that can sense and control the physical world around them
- To Understand basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world
- To Explore protocols, data conversion process, Api and expansion boards for real world interaction

COURSE OUTCOMES (COs) : (3- 5)

CO1	Evaluate various challenges in IOT
CO2	Understand the Hardware prototype
CO3	Analyze the basic circuits & sensors
CO4	Analyze the data conversion process
CO5	Understand the constraints of real time system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	2	3	2	3	3	2	2	3
CO2	3	2	2	2	2	3	2	3	3	2	2	3
CO3	3	3	3	2	3	3	2	3	2	2	3	2
CO4	3	2	2	1	2	2	1	1	2	2	1	1
CO5	3	2	2	2	2	1	2	2	1	2	2	2

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2
CO2	2	2	2	2
CO3	2	2	2	3
CO4	1	2	3	2
CO5	2	3	2	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE11	PROGRAMMING FOR IOT BOARDS	Ty	3	0/0	0/0	3

UNIT-I IOT AND EMBEDDED SYSTEMS

IoT- Introduction and Characteristics, Things, Architecture, Enabling Technologies, Challenges, Levels; Embedded Systems - Embedded vs General Computing System, Classification, Design Challenges, MCU Architecture - 8051, PIC, ARM Introduction to IoT Boards Environment - board, IDE, shields; Programming - syntax, variables, types, operators, constructs and functions; sketch - skeleton, compile and upload, accessing pins; debugging - UART communication protocol and serial library

UNIT-II INTERFACING WITH IOT BOARDS

Circuits - design, wiring, passive components; sensors and actuators, interfacing, read and write; software libraries to handle complicated hardware; shields, interfacing and libraries Single Board Computers and Python 4 hours Board schematic, setup, configure and use, OS implications; linux - basics, file system and processes, shell CLI, GUI; python - basics, API's RPi.GPIO, PWM library to access pins, Tkinter

UNIT-III INTERFACING WITH SINGLE BOARD COMPUTERS

Internet Connectivity, Standard Internet Protocols, MQTT, CoAP, Networking Socket Interface; Cloud - Public APIs and SDK's for accessing cloud services, Twitter API using Twython package; Interfacing - sensors and actuators, Pi Camera, Servo, A/D, D/A

UNIT-IV EMBEDDED PROGRAMMING AND RTOS

MCU - GPIO, WDT, timers/counters, IO, A/D, D/A, PWM, Interrupts, Memory, serial communicationUART, I2C, SPI, Peripheral Interfacing OS - basics, types, tasks, process, threads (POSIX Threads),thread preemption, Preemptive Task Scheduling Policies, Priority Inversion, Task communication, Task Synchronization issues - racing and deadlock, binary and counting semaphores (Mutex example), choosing RTOS

UNIT-V REAL WORLD PROJECTS

IoT Integrated Primary Health Care, Large Scale Face Detection by AI Powered Street Lights, Cloud IoT Systems for Smart Agriculture, Smart Home Gadgets, Autonomous Car Features – speed and horn intensity control. Recent Trends

Total Lecture hours: 45 hours

Text Book(s)

1. Yamanoor, Sai, and Srihari Yamanoor. Python Programming with Raspberry Pi, 1st edition, Packt Publishing Ltd, 2017.
2. Donald Norris, The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and BeagleBone Black, 1st edition,McGraw Hill Education, 2015

Reference Books

1. Marco Schwartz, Home Automation with Arduino, 3rd edition, Open Home Automation 2014. Schwartz, Marco.
2. Internet of things with arduino cookbook, 1st edition, Packt Publishing Ltd, 2016. Kooijman, Matthijs.
3. Building Wireless Sensor Networks Using Arduino, 1st edition, Packt Publishing Ltd, 2015.

Department of Computer Science and Engineering

Subject Code: **BCS21BE12**	Subject Name : FOG AND EDGE COMPUTING	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To Become familiar with the concepts of Fog and Edge computing
- To understand the architecture and its components and working of components and its performance
- To explore Fog and Edge computing on security, multimedia and smart data To create a model in fog and edge computing scenario Course Outcomes
- Understand the use of IoT architecture with its entities and protocols via edge and fog, up to the cloud.
-

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the concepts of FOG
CO2	Understand the architecture and its components
CO3	Analyze the fog and edge computing security
CO4	Apply the IOT architecture and protocols via edge
CO5	Analyze various issues related to Fog and Edge compuitn .

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	3	2	2	3	3	3	3
CO2	2	2	3	3	2	2	3	2	3	2	1	2
CO3	2	2	2	2	2	3	2	2	2	2	2	2
CO4	3	3	3	2	1	2	2	3	2	3	1	2
CO5	2	2	2	2	1	1	2	2	1	2	2	1

Department of Computer Science and Engineering

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	2	2	3	2
CO3	3	3	2	3
CO4	3	2	3	2
CO5	2	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE12	FOG AND EDGE COMPUTING	Ty	3	0/0	0/0	3

UNIT I - INTRODUCTION TO FOG AND EDGE COMPUTING

Fog and Edge Computing (FEC) Definition-FEC Completing the Cloud - Advantages of FEC-Hierarchy of FEC-Business Models-Opportunities and Challenges- Addressing the Challenges in Federating Edge Resources – Introduction – The networking challenge- The management challenges

UNIT II – MIDDLEWARE

Introduction-Need for Fog and Edge Computing Middleware- Design Goals- State-of-the-Art Middleware Infrastructures-System Model-Proposed Architecture-Case Study Example-Future Research Directions. Lightweight Container Middleware

for Edge Cloud Architectures-Introduction-Clusters for Lightweight Edge Clouds-Architecture Management – Storage and Orchestration- IoT Integration- Security Management for Edge Cloud Architectures -Future Research Directions

UNIT III – DATA MANAGEMENT AND PREDICTIVE ANALYSIS IN FOGCOMPUTING

Introduction to data management- Fog Data Management-Future Research Directions- Predictive Analysis to Support Fog Application Deployment-Introduction-Motivating Example: Smart Building- Predictive Analysis with FogTorch- Motivating Example (continued)-Future Research Directions - Survey of ML Techniques for Defending IoT Devices - Machine Learning in Fog Computing - Future Research Directions

UNIT IV – OPTIMIZATION PROBLEMS IN FOG AND EDGE COMPUTING

The Case for Optimization in Fog Computing- Formal Modeling- Framework for Fog Computing Metrics -Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing -optimization Techniques

UNIT V – CASE STUDIES

Smart Surveillance Video Stream Processing at the Edge for Real-Time -Smart Transportation Applications-Intelligent Traffic Lights Management (ITLM) System -Fog Orchestration Challenges and Future Directions.

TOTAL PERIODS: 45

Text Books: 1.

Rajkumar Buyya, Satish Narayana Srirama, “Fog and Edge Computing: Principles and Paradigms”, Wiley series on Parallel and Distributed Computing.

Reference Books:

1. Fog Computing: A Platform for Internet of Things and Analytics, Flavio Bonomi, Rodolfo Milito, Preethi Natarajan and Jiang Zhu, Springer International.

2. Fog Computing and Its Role in the Internet of Things, FlavioBonomi, Rodolfo Milito, Jiang Zhu, Sateesh Addepalli, MCC‟12, August 17, 2012, Helsinki, Finland

3. A Survey of Fog Computing: Concepts, Applications and Issues , Shanhe Yi, Cheng Li, Qun 4. Li, Mobidata‟15, June 21, 2015, Hangzhou, China.

Department of Computer Science and Engineering

ubject Code: **BCS21BE13**	Subject Name : CYBER AND DIGITAL FORENSICS	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite:	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Will gain the knowledge to implement various security attacks.
- Will get the ideas in various ways to trace an attacker.
- Will get the practical exposure to forensic tools

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the knowledge to implement security attacks
CO2	Analyze the ides in various ways to trace an attacker
CO3	Apply the practical exposure to forensic tools
CO4	Understand the social l media investigation
CO5	Analyze the surveillance tools

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**2**
CO2	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**1**	**1**	**3**	**1**
CO3	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**
CO4	**3**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**
CO5	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**1**	**2**	**2**	**1**	**2**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**3**	**2**	**3**

Department of Computer Science and Engineering

CO2	**3**	**2**	**2**	**2**
CO3	**2**	**3**	**3**	**3**
CO4	**3**	**2**	**3**	**2**
CO5	**2**	**3**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE13	CYBER AND DIGITAL FORENSICS	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT-I: INTRODUCTION TO IT LAWS & CYBER CRIMES

Internet, Hacking, Cracking, Viruses, Virus Attacks, Pornography, Software Piracy, Intellectual property, Legal System of Information Technology, Social Engineering, Mail Bombs, Bug Exploits, and Cyber Security. Legal and Ethical Principles : Introduction to Forensics – The Investigative Process – Code of Ethics, Ethics of Investigations, Evidence Management – Collection, Transport, Storage, access control, disposition

UNIT-II: FORENSIC SCIENCE

Principles and Methods – Scientific approach to Forensics, Identification and Classification of Evidence, Location of Evidence, Recovering Data, Media File Forensic Steps, Forensic Analysis – Planning, Case Notes and Reports, Quality Control

UNIT-III: DIGITAL FORENSICS

Hardware Forensics – Hidden File and Anti- forensics - Network Forensics – Virtual Systems - Mobile Forensics Digital Watermarking Protocols: A Buyer-Seller Watermarking Protocol, an Efficient and Anonymous Buyer-Seller Watermarking Protocol, Extensions of Watermarking Protocols, Protocols for Secure Computation

UNIT-IV: APPLICATION FORENSICS

Tools and Report Writing – Application Forensics, Email and Social Media Investigations, Cloud Forensics, Current Digital Forensic Tools, Report Writing for Investigations

UNIT-V: COUNTER MEASURES

Defensive Strategies for Governments and Industry Groups, Tactics of the Military, Tactics of Private Companies, Information Warfare Arsenal of the future, and Surveillance Tools for Information Warfare of the Future.

TOTAL PERIODS: 45 hrs

Text Books:

1. Bill Nelson, Christopher Steuart, Amelia Philips, “Computer Forensics and Investigations”, Delmar Cengage Learning; 5th edition January 2015

2. Chuck Eastom, “Certified Cyber Forensics Professional Certification:, McGraw Hill, July 2017

3. Nilakshi Jain, Dhananjay Kalbande, “Digital Forensic : The fascinating world of Digital Evidences” Wiley India Pvt Ltd 2017.

4. John R.Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Laxmi Publications, 2015.

Reference Books:

1. MarjieT.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3rd Edition, Prentice Hall, 2013.

2. Clint P Garrison “Digital Forensics for Network, Internet, and Cloud Computing A forensic evidence guide for moving targets and data , Syngress Publishing, Inc. 2010

Department of Computer Science and Engineering

Subject Code: BCS21BE14	Subject Name : SMART SENSOR TECHNOLOGY	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To Study the basics of sensor technology and the various sensors.
- To Understand the basics of optimal system layout, partitioning and device scaling.
- To Acquaint with various thick and thin film techniques used in sensor development.
- To Know about various sensor technologies for flow and level measurement.
-

COURSE OUTCOMES (COs) : (3- 5)

CO1	Analyze the basics of sensor technology
CO2	Understand the basics of optimal system
CO3	Distinguish sensor technologies for Force, Pressure and Torque measurement
CO4	Apply Sensor for acceleration, vibration
CO5	Analyze the sensor technologies for flow and level measurement

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	3	3	3	3	3	3	2
CO2	2	3	2	2	2	2	3	2	2	2	2	3
CO3	2	2	2	3	2	2	2	1	3	1	2	1
CO4	2	2	3	2	3	2	2	2	2	2	1	2
CO5	3	2	2	2	2	3	3	3	1	2	2	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3
CO2	3	2	2	2
CO3	2	3	3	3
CO4	3	2	2	2
CO5	2	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✔							

SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
BCS21BE14	SMART SENSOR TECHNOLOGY	Ty	3	0/0	0/0	3

UNIT-I DEVELOPMENTS IN SENSOR TECHNOLOGY

Semiconductor sensors, smart sensors, micro sensors, fiber optic sensors, chemical sensors, bio sensors, TEDs. Sensor Design and Packaging Partitioning, Layout, technology constraints, scaling, compatibility study

UNIT-II THICK AND THIN FILM TECHNOLOGY

Thick-film processing-screen printing, Lasering of substrates, curing, low temperature co-fired ceramic processing, wire bonding. Micro machining, IOC (Integrated Optical circuit) fabrication process. Thin Film Technology Thin film formation and characterization- sol-gel method, chemical vapour deposition, physical vapour deposition, sputtering, plasma/Ion beam deposition, structural and physical properties, Applications- Thin films for microelelctronics, MEMS, optical coatings, photodetectors, smart sensors.

UNIT-III SENSOR TECHNOLOGIES FOR FLOW AND LEVEL MEASUREMENT

pressure- primary element options, mechanical and electronic flowmeters- design, installation and maintenance, selection and sizing, recent developments. Level probe design, materials, characteristics, installation considerations, applications and manufacturers

UNIT-IV SENSOR TECHNOLOGIES FOR FORCE, PRESSURE AND TORQUE MEASUREMENT

Load cell- bending beam, column and shear-web, elastic diaphragm, torsion bar- materials, characteristics, design considerations and mounting procedures, applications and manufacturers.

UNIT-V SENSOR TECHNOLOGIES FOR ACCELERATION, VIBRATION AND SHOCK MEASUREMENT

Mass-Spring system, sensing technologies, selecting and specifying accelerometers, applicable standards, interfacing and design, applications and manufacturers. Contemporary issues

Total Lecture Hours :45

Text Book(s)

1. Jon S Wilson, Sensor Technology Handbook, 2005, Elsevier Inc., USA.

Reference Books 1.

B C Nakra& K K Choudhry, Instrumentation Measurement and Analysis, 2010, 3rd ed., Tata McGrawHill, India.

2. Jacob Fraden, Hand Book of Modern Sensors: Physics, Designs and Applications, 2010, 3rd ed., Springer, USA.

3. John G Webster, Measurement, Instrumentation and sensor Handbook, 2014, CRC Press,

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

OPEN ELECTIVES -CIVIL

Subject Code: BCE18 OE1/ BCE20 OE1	Subject Name : WATER POLLUTION AND ITS MANAGEMENT	T y/ Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE : Tolearnthefundamentalconceptsinthefieldofwaterpollutionanditsmanagement

COURSE OUTCOMES (COs) : (3- 5) At the end of the course, Students will be able to

CO1	To study the various Effects of Water pollution
CO2	To learn the importance of methods of control of Water Pollution
CO3	To understand the various Water Pollution control Act

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	2	3	3	-	-	2	1
CO2	3	3	3	3	-	2	3	3	-	-	2	1
CO3	3	3	3	3	-	2	3	3	-	-	2	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	**3**	**3**	3	3
CO2	**3**	**3**	3	3
C03	**3**	**3**	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

							√						

Subject Code	Subject Name	T y/ Lb/ ETL	L	T / S.Lr	P/ R	C
BCE18OE1/ BCE20OE1	WATER POLLUTION AND ITS MANAGEMENT	Ty	3	0/0	0/0	3

UNIT I SOURCES&C

HARACTERISTICSOFWATERPOLLUTION 9 Hrs

Waterpollution-Sources&typesofwaterpollution–Physical,chemical&biological–Effectofwater pollution.DrinkingwaterqualitystandardswasteWatertreatment–Primary,secondary,tertiary-water pollution prevention & control act –1974.

UNIT II WATER QUALITY&STANDARDS 9 Hrs

Quality of surface waters, Water quality in flowing waters, Water quality in impounded waters, Groundwater quality, Water quality standard Microbiological quality of drinking water, and Chemical quality of drinking water

UNIT III INDUSTRIALACTIVITY&MITIGATIONMEASURES 9 Hrs

Role of water in different industries-Effluent discharge characteristics-Discharge Standards for Rivers and Streams-Role of stakeholders, Public NGOS, Government in Protection of Water bodies-Control Measures-Mitigation Measures for Industrial Water Contamination due to industries.

UNIT IV WATERPOLLUTIONREGULATIONS 9 Hrs

Administrative regulation under recent legislations in water pollution control.Water (Prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (Prevention &control of pollution) Rules 1975 Water (Prevention & control of pollution) Cess Act. 1977 as amended by Amendment Act1991.

UNIT V ROLE OFREGULATORYBOARDS 9 Hrs

SustainableDevelopment,RainWaterHarvesting-Methods-WaterPollution-CausesandEffects-RoleofRegulatorybodiesandLocalbodies-CPCB-TWADBoard–CMWSSBetc-CaseStudies related to Effective WaterManagement

Total Hours: 45

TEXT BOOKS

1.Fair.G.M,“WaterandWastewaterengineeringVol.I&II”.JohnWileyandsons,Newyork. 2010.

REFERENCES

1. Metcalf & Eddy, “Wastewater engineering, Treatment and Reuse”, Tata MacGrawhill publications,2008.
2. Eckenfelder,W.W.,""IndustrialWaterPollutionControl",McGraw-Hill,2009.
3. Arceivala.S.J,"WastewaterTreatmentforPollutionControl",TataMcGraw-Hill,2008.
4. “Aruna Venkat Environmental Law and Policy”, PHI learning private limited New Delhi, 2011.

5. WaterManagementInIndia,"ConceptPublishingCompany",NewDelhi,2004.

Department of Computer Science and Engineering

Subject Code: BCE18OE2/ BCE20OE2	Subject Name ENVIRONMENT,HEALTHANDSAFETY ININDUSTRIES	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE

- Tounderstandthebasicneedsofsafetyin humanhealth,environmentalsafety,electricalsafety,safetyagainst accidents and fire

safety in various industries

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students learn the occupational safety and hygiene
CO2	They understand the workplace safety and their responsibility.
CO3	Student possesses an awareness on environment, health and safety in industries

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	3	3	3	3	-	-	3	3
CO2	3	2	-	-	3	3	3	3	-	-	3	3
CO3	3	2	-	-	3	3	3	3	-	-	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	3				
CO2	3	3	3	3				
CO3	3	3	3	3				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Cate	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

						√						

Department of Computer Science and Engineering

Subject Code:	Subject Name	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
BCE18OE2/ BCE20OE2	ENVIRONMENT,HEALTHANDSAFETY ININDUSTRIES	Ty	3	0/0	0/0	3

UNITI INTRODUCTION 9Hrs

Need for developing Environment, Health and Safety systems in work places, Status and relationship of Acts, Regulations and Codes of Practice, Role of trade union safety representatives .International initiatives, Ergonomics and workplace.

UNITII OCCUPATIONALHEALTHANDHYGIENE 9 Hrs

Definition of the term occupational health and hygiene, Categories of health hazards, Exposure pathways and human responses to hazardous and toxic substances, Advantages and limitations of environmental monitoring and occupational exposure limits, Hierarchy of control measures for occupational health risks, Role of personal protective equipment and the selection criteria.

UNITIII WORKPLACESAFETYANDSAFETYSYSTEMS 9 Hrs

Features of the satisfactory design of work premises HVAC, ventilation. Safe installation and use of electrical supplies, Fire safety and first aid provision, Significance of human factors in the establishment and effectiveness of safe systems, Safe systems of work for manual handling operations, Control methods to eliminate or reduce the risks arising from the use of work equipment, Requirements for the safe use of display screen equipment, Procedures and precautionary measures necessary when handling hazardous substances, Contingency arrangements for events of serious and imminent danger.

UNITIV TECHNIQUESOF ENVIRONMENTALSAFETY 9Hrs

Functions and techniques of risk assessment, inspections and audits, Investigation of accidents- Principles of quality management systems in health and safety management.

UNITV EDUCATIONANDTRAINING 9 Hrs

Factors to be considered in the development of effective training programmes, Principles and methods of effective training, Feedback and evaluation mechanism.

Total Hours: 45

REFERENCE

1. EnvironmentalandHealthandSafetyManagementbyNicholasP.CheremisinoffandMadelyn L. Graffia, William Andrew Inc. NY, 1995
2. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ. Effective Environmental, Health, and Safety Management Using the TeamApproachbyBillTaylor,CulinaryandHospitalityIndustryPublicationsServices2005

Department of Computer Science and Engineering

Subject Code: BCE18OE3/ BCE20OE3	Subject Name **GREEN BUILDING AND VASTU CONCEPTS**	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE

- Toexposethenecessityofgreenbuildingandacquireknowledgeonvastu-shastra

COURSE OUTCOMES (COs) : (3- 5) On completion of the course the students would have

CO1	Students should be able to describe the importance and necessity of green building.
CO2	Students should be able to assess a building on the norms available for green building.
CO3	Students should be able to suggest materials and technologies to improve energy efficiency of building.
CO4	Students should be able to design and assess building with norms of vastu-shastra

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	3	3	3	3	-	-	3	2
CO2	3	-	-	-	3	3	3	3	-	-	3	2
CO3	3	-	-	-	3	3	3	3	-	-	3	2
CO4	3	-	-	-	3	3	3	3	-	-	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	3				
CO2	3	3	3	3				
CO3	3	3	3	3				
CO4	3	3	3	3				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code:	Subject Name	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
BCE18OE3/ BCE20OE3	**GREEN BUILDING AND VASTU CONCEPTS**	**Ty**	**3**	**0/0**	**0/0**	**3**

UNITIINTRODUCTION OFGREENBUILDING 9Hrs

Concept of green building, History of green building, Need of green building in present scenario, ImportanceofgreenbuildingMeritsanddemerits,Classificationofgreenbuilding,Assessmentmethods Global assessment and certification, Local assessment, LEED India GRIHA (Green Rating for Integrated HabitatAssessment)

UNITIIPRINCIPLESANDELEMENTSOFDESIGNOFGREENBUILDING 9Hrs

Sustainability: concept and reality 2. Climate responsive process of design: Climatic zones, design sequence, shelter or form, land form, vegetation, water bodies, street widths, open spaces, ground character, plan form, orientation, roof form 3. Shading devices and their effect

UNITIIITHERMAL COMFORT INSIDETHEBUILDING 9Hrs

Factors affecting, indices, cooling and heating requirement, Heat transmission through building sections, thermal performance of building sections, simple calculation for U value and insulation thickness .Day lighting. Ventilation

UNITIVWATERCONSERVATIONANDBUREAUOFENERGYEFFICIENCY 9Hrs

3 R's for water conservation, rain water harvesting, low flow fixtures, grey water recycling Material conservation: concept of embodied energy, low energy materials, sustainable materials, alternative materials Concept of carbon emission and its reduction Functions, policies, guidelines, Energy Conservation Building Code, Study of existing green buildingsIntroduction to Energy efficiency softwares, carbon calculators

UNIT VVASTUCONCEPT 9Hrs

History, scientific approach, importance of shapes size and direction, vastu of a plot, elements of vastu for selecting a plot, vastu of a residence, vastu of existing building

Total Hours: 45

TEXT BOOKS

1. Climate responsive architecture (A design hand book for energy efficient buildings), Arvind Krishnana,SimosYannas,NickBaker,SVSzokolay,McGrawhillEducation,Seventhreprint, 2013
2. Renewable Energy and Environment -A Policy Analysis for India, H, Ravindranath, K Usha Rao, B Nataraja n, P Monga, Tata McGraw Hill,2000
3. EnergyandtheEnvironment,JMFowler,McGrawHill,NewYork,2ndEdition,1984

REFERENCE

1. Handbookonfunctionalrequirementsofbuildings(SP41),BIS,NewDelhi,1987
2. EnergyConservationbuildingcode(ECBC),Bureauofenergyefficiency,2011

Department of Computer Science and Engineering

Subject Code: BCE18OE4/ BCE20OE4	Subject Name CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT	Ty /Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE

- TounderstandtheEarth'sClimateSystemandtheconceptofGlobalWarming,theimpactofclimate change on society and its mitigationmeasures.

COURSE OUTCOMES (COs) : (3- 5)
At the end of the course the student will be able to

CO1	Understand the global climate change and its effects
CO2	Learn about climate change adaptation and various mitigation measures
CO3	Understand the concept of clean energy and energy conservation

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			3	3	3	3			3	3
CO2	3	2			3	3	3	3			3	3
CO3	3	2			3	3	3	3			3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

Subject Code:	Subject Name	Ty / Lb / ETL	L	T / S.Lr	P/ R	C
BCE18OE4/BCE20OE4	CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT	Ty	3	0/0	0/0	3

UNITI EARTH'SCLIMATESYSTEM 9Hrs

Introduction-Climate in the spotlight -– Climate Classification - Global Wind Systems -Cloud Formation and Monsoon Rains – Storms and Hurricanes – The Hydrological Cycle – Global Ocean Circulation –Solar Radiation –The Earth's Natural Green House Effect – Green House Gases and Global Warming – CarbonCycle.

UNITII OBSERVEDCHANGESANDITSCAUSES 9 Hrs

Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of ClimateChange– ClimateSensitivityandFeedbacks–TheMontrealProtocol–UNFCCC–IPCC.

UNITIII IMPACTS OFCLIMATECHANGE 9Hrs

Impacts of Climate Change on various sectors -Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNITIV CLIMATECHANGEADAPTATIONANDMITIGATIONMEASURES 9Hrs

Adaptation Strategy/Options in various sectors -Key Mitigation Technologies and Practices –Carbonsequestration – Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regionalcooperation.

UNITV CLEAN TECHNOLOGYANDENERGY 9Hrs

Clean Development Mechanism –Carbon Trading examples of future Clean Technology – Biodiesel– Natural Compost – Eco-Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power.

Total Hours: 45

REFERENCES

1. AnilMarkandya,ClimateChangeandSustainableDevelopment:ProspectsforDeveloping Countries, Routledge,2002
2. Heal, G. M., Interpreting Sustainability, in Sustainability: Dynamics and Uncertainty, Kluwer Academic Publ.,1998
3. Jepma, C.J., and Munasinghe, M., Climate Change Policy – Facts, Issues and Analysis, Cambridge University Press,1998
4. Munasinghe, M., Sustainable Energy Development: Issues and Policy in Energy, EnvironmentandEconomy:AsianPerspective,KleindorforP.R.et.al(ed.),EdwardElgar,1996
5. DashSushilKumar,"ClimateChange–AnIndianPerspective",CambridgeUniversityPress India Pvt. Ltd,2007.

Department of Computer Science and Engineering

Subject Code: BCE18OE5/ BCE20OE5	Subject Name INTELLIGENT TRANSPORTATION SYSTEMS	Ty / Lb ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE

- ToexposetherecentadvancementsinTransportSystems

COURSE OUTCOMES (COs) : (3- 5) On completion of the course the students would have

CO1	Knowledge on the various principles and aspects of Intelligent Transport System.
CO2	Knowledge on intersection management
CO3	Knowledge on advanced transport system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	1	3		3			3	3
CO2	3	3	1	3	1	3		3			3	3
CO3	3	3	1	3	1	3		3			3	3

COs / PSOs	PSO1	PSO2	PSO 3	PSO 4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code: BCE18OE5/ BCE20OE5	Subject Name	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	INTELLIGENT TRANSPORTATION SYSTEMS	Ty	3	0/0	0/0	3

UNITI INTRODUCTIONTOINTELLIGENTTRANSPORTSYSTEM 8Hrs

Definition–RoleandResponsibilities–AdvancedTravellerInformationSystem–FleetOrientedITS Services– Electronic Toll Collection – Critical issues – Security - Safety 21

UNITII ITS ARCHITECTUREANDHARDWARE 9Hrs

Architecture–ITSArchitectureFramework–HardwareSensors–VehicleDetection–Techniques– DynamicMessage Sign – GPRS – GPS – Toll Collection

UNITIII INTERSECTIONMANAGEMENT 10Hrs

VideoDetection–VirtualLoop-Cameras-ANPR–IRLighting–IntegratedTrafficManagement– ControlCentre – Junction Management Strategies

UNITIV ADVANCEDTRANSPORTMANAGEMENTSYSTEM 10Hrs

ATMS–RouteGuidance–Issues-TravelInformation–PreTripandEnrouteMethods–Historical– Current–PredictiveGuidance–DataCollection–Analysis–DynamicTrafficAssignment(DTA)– Components–Algorithm

UNITV ADVANCEDTRAVELLERANDINFORMATIONSYSTEM 8Hrs

Basic ATIS Concepts – Smart Route System – Data Collection – Process – Dessemination to Travelers

–Evaluation of Information – Value of Information – Business Opportunities

Total Hours: 45

REFERENCES

1. IntelligentTransportSystems,IntelligentTransportationPrimer,Washington,US,2001
2. HenryF.Korth,andAbrahamSiberschatz,DataBaseSystemConcepts,McGrawHill,1992
3. E.Turban,"DecisionSupportandExportSystemsManagementSupportSystems",Maxwell Macmillan,1998
4. SitausuS.Mittra,"DecisionSupportSystems–ToolsandTechniques",JohnWiley,NewYork, 19865.CycleW.HalsappleandAndrewB.Winston,"DecisionSupportSystems–Theoryand Application", Springer Verlog, New York,1987

Department of Computer Science and Engineering

Subject Code: BCE18OE6/ BCE20OE6	Subject Name GEOGRAPHICAL INFORMATION SYSTEM AND MAPPING	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- Introducingstudentstotheuseofgeographicinformationsystemsintheurban/suburban/metropolitan environment

COURSE OUTCOMES (COs) : (3- 5) On completion of the course the students would have

CO1	To understand the GIS, background, development and components of GIS
CO2	To study the data capturing for GIS techniques and data base management
CO3	To study the analysis of various spatial and non-spatial data in GIS

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3		3		3		2		3	2
CO2	3		3		3		3		2		3	2
CO3	3		3		3		3		2		3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

						√						

Department of Computer Science and Engineering

Subject Code: BCE18OE6/ BCE20OE6	Subject Name	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	GEOGRAPHICAL INFORMATION SYSTEM AND MAPPING	Ty	3	0/0	0/0	3

UNITI INTRODUCTIONTOGIS 9Hrs

Definition of GIS, Historical background Concepts and Basic Requirements. GIS Softwares Elements of GIS Cartography – definition and importance Map definition - Types Map Analysis Coordinate system Different Coordinatesystem

UNITII DATABASEMANGEMENT 9Hrs

Introduction – Types of data Spatial data – Nonspatial data. Data input - Methods Data Output - Methods Software Modules Vector data – Structure - Topology Raster data - Structure Raster data – Structure – Merits and Demerits

UNITIII DATAANALYSIS 9Hrs

Spatial data analysis Non Spatial Data analysis Manipulation – Spatial interpolation Data retrieval – Reclassification Techniques. Buffer analysis Vector and Topological Overlay analysis Raster overlay analysis Measurement - Query Record Modeling and Expert System

UNITIV DIGITALELEVATIONMODEL 9Hrs

Introduction – Data Capture Generation of DEM - Parameters Modeling Surface Applications of DEM Cost and Path analysis Digital Terrain Visualization TIN Generation DTM and DEM advantages DTM and DEM advantages

UNITV APPLICATIONOFGIS 9Hrs

Use of GIS in Resource Mapping Use of GIS in Ground Water and Runoff Modeling Use of GIS in Flood monitoring and Wetland Management. Use of GIS in Forest Management. Land use and Land cover analysis Use of GIS in Geology Use of GIS in Regional and Urban Planning Use of GIS in Agriculture andsoil Integrated with remote sensing

Total Hours: 45

TEXT BOOKS

- AnjiReddy.M,"RemotesensingandGeographicalinformationsystem",B.SPublications, 2011.

REFERENCES

1. Chestern, "Geo Informational Systems - Application of GIS and Related Spatial InformationTechnologies
2. », ASTER Publication Co.,1992.
3. Jeffrey Star and John Estes, "Geographical Information System - An Introduction", Prentice Hall,1990.
4. Burrough .P.A, "Principles of GIS for Land Resources Assessment", Oxford

Publication,1980

5. SatheeshGopi, “Global Positioning System - Principles and Applications,” Tata McGrawHillPublishing
6. Company Limited, New Delhi (India),2005

7.

ubject Code: BCE18OE7/ BCE20OE7	**Subject Name** **INDUSTRIAL POLLUTION PREVENTION AND CLEANER PRODUCTION**	**Ty/ Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- Geteducatedoncompletemanagementprinciplesrelatedtothe CleanerProductionandControlindustrial Pollution

COURSE OUTCOMES (COs) : (3- 5) On completion of the course the students would have

CO1	Know the Basics of sustainable development and about prevention against pollution
CO2	Know the concept of pollution prevention and cleaner production
CO3	Get educated on Life cycle assessment concept.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	3	3	3	3	3	2	-	-	2
CO2	3	-	-	3	3	3	3	3	2	-	-	2
CO3	3	-	-	3	3	3	3	3	2	-	-	2

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2
CO2	3	3	2	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

						√						

Department of Computer Science and Engineering

Subject Code: BCE18OE7/ BCE20OE7	Subject Name	Ty/ Lb/ ETL	L	T / S.Lr	P/ R	C
	INDUSTRIAL POLLUTION PREVENTION AND CLEANER PRODUCTION	TY	3	0/0	0/0	3

UNIT I SUSTAINABLE DEVELOPMENT 9 Hrs

Sustainable Development-Indicators of Sustainability-Sustainability Strategies-Barriers to Sustainability-Industrial activity and Environment. Industrialization and sustainable development Industrial Ecology-Cleaner Production (CP) in Achieving Sustainability-Prevention versusControl of Industrial Pollution Environmental Policies and Legislations Regulations to Encourage Pollution Prevention and Cleaner Production-Regulatory versus Market BasedApproaches

UNITII POLLUTIONPREVENTION 9 Hrs

Definition-Importance-Historical evolution Benefits-Promotion-Barriers-Role of Industry, Government and Institutions - Environmental Management Hierarchy Source Reduction Techniques- Process and equipment optimization, reuse, recovery, recycle Raw material substitution-Internet Information and Other CP Resources.

UNITIII CONCEPT OFCLEANERPRODUCTION 9 Hrs

Overview of CP Assessment Steps and skills, Preparing for the site visit, Information Gathering, and process flow diagram, material balance , CP Option Generation Technical and Environmental feasibility analysis-Economic valuation of alternatives-total cost analysis Financing- Establishing a program-Organizing a program-preparing a program plan- Measuring progress Pollution prevention and cleaner production Awarenessplan –Waste audit-Environmental Statement

UNITIV LIFECYCLEASSESSMENT 9 Hrs

Elements of LCA-Life Cycle Costing Eco Labeling –Design for the Environment International Environmental Standards-ISO 14001- Environmental audit.

UNITV CASESTUDIES 9 Hrs

Industrial application of CP, LCA, EMS Environmental Audits.

Total Hours: 45

TEXT BOOKS

1. PaulLBishop,“PollutionPreventionFundamentalandPractice”,McGraw-Hill International,2009.
2. Prasad modak, C.Visvanathan and Mandarparasnis”Cleaner Production Audit”, Environmental SystemReviews,No.38,AsianInstituteofTechnology,Bangkok,2005.
3. S.P.Mahajan,“PollutionControlInProcessIndustries”,McGraw-HillInternational,2005.

REFERENCES

1. World Bank Group, “Pollution Prevention and Abatement Handbook-Towards Cleaner Production”,WorldBankandUNEP,WashingtonD.C,2005.
2. Arceivala,S.J.,"WastewaterTreatmentforPollutionControl",TataMcGraw-Hill,2008.

3.

Subject Code: BCE18OE8/ BCE20OE8	Subject Name AIR POLLUTION AND CONTROL	Ty/ Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To take up the basic concepts of airpollution.
- Thecontentsinvolvedtheknowledgeofcausesofair pollution
- Thecontentsinvolvedtheknowledgeofhealthrelatedtoair pollution

COURSE OUTCOMES (COs) : (3- 5) On completion of the course the students would have

CO1	Concepts of air pollution.
CO2	How to estimate the quantity of air pollutant.
CO3	Be able to develop control technologies.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3				3	3	3	3	2		3	3
CO2	3				3	3	3	3	2		3	3
CO3	3				3	3	3	3	2		3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

SubjectCode: BCE18OE8/ BCE20OE8	Subject Name	TY/Lb /ETL	L	T / S.Lr	P/ R	C
	AIR POLLUTION AND CONTROL	TY	3	0/0	0/0	3

UNITI INTRODUCTION 9 Hrs

History of Air pollution and episodes, Sources of air pollution and types,Introduction to meteorology and transport of air pollution: Global winds, Headley cells, wind rose terrestrial wind profile, Effects of terrain and topography on winds, lapse rate, maximum mixing depths, plume rise

UNITII TRANSPORTOFPOLLUTIONINATMOSPHERE 9 Hrs

Plume behavior under different atmospheric conditions, Mathematical models of dispersion of air pollutants, Plume behavior in valley and terrains. Plume behavior under different meteorological conditions, Concept ofisoplates

UNITIII EFFECTS OFAIRPOLLUTION 9 Hrs

Effects of Air Pollution on human beings, plants and animals and Properties. Global Effects-Green house effect, Ozone depletion, heat island, dust storms, Automobile pollution sources and control, Photochemical smog, Future engines and fuels

UNITIV AIRPOLLUTIONCONTROL 9 Hrs

Air Pollution control- at source-equipments for control of air pollution-For particulate matter-Settling chambers-Fabric filters-Scrubbers-Cyclones-Electrostatic precipitators, For Gaseous pollutants-control by absorption-adsorption-scrubbers-secondary combustion after burners, Working principles advantages and disadvantages, design criteria and examples.

UNITV AIRQUALITYSAMPLINGANDMONITORING 9 Hrs

Stack sampling, instrumentation and methods of analysis of SO2, CO etc, legislation for control of air pollution and automobile pollution

Total Hours: 45

REFERENCE:

1. H.CParkins,AirPollutionMcGrawHillPublication
2. H.S.Peavy,D.R.Row&G.Tchobanoglous,EnvironmentalEngineering,McGrawHill InternationalEdition
3. MartinCrawford,AirPollutionControlTheory,TMHPubl.

WEB MATERIALS:

1. http://www.epa.gov
2. http://www.indiaenvironmentportal.org.in
3. http://nptel.iitm.ac.in
4. http://www.filtersource.com
5. https://dgserver.dgsnd.gov

6.

OPEN LAB

Subject Code: BCE18OL1/ BCE20OL1	Subject Name : BUILDING DRAWING PRACTICE USING AUTOCADD	Ty/Lb /ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Basic Engineering Graphics	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Tointroducethestudentstodrafttheplan,elevationandsectionalviewsofbuildingsinaccordancewith developmentandcontrolrulessatisfyingorientationandfunctionalrequirementsasperNationalBuilding Code.

COURSE OUTCOMES (COs) : (3- 5) At the end of the course, the student will be able to:

CO1	know about the basic principles of Building Drawing
CO2	know Basic commands of a popular drafting package
CO3	Acquire knowledge on plan, elevation and section of buildings

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					2		2			2	
CO2	3							2			2	
CO3	3					2		2			2	
COs / PSOs	PSO1		PSO2		PSO3		PSO4					
CO1	3		3		3		3					
CO2	3		3		3		3					
CO3	3		3		3		3					

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

							√					

Department of Computer Science and Engineering

Subject Code: BCE18OL1 /BCE20OL1	Subject Name :	Ty/Lb /ETL	L	T / S.Lr	P/ R	C
	BUILDING DRAWING PRACTICE USING AUTOCADD	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Learn and use basic AutoCAD commands - manage drawing using layers, colour and line types-completebasiccaddrawings,withborders,textanddimensions-useandedittextand textstyles–Methodofscalesinvariousdrawing-understandandtheuseofblocks.
2. Developmentoflineplanforresidentialbuilding.oneforsinglestoriedbuilding
3. Developmentoflineplanforresidentialbuilding.onefortwostoriedbuilding
4. Submission drawing for residential building including its planning and with area and parkingstatementsandallotherdetailsasperthenormsandlocalbye-laws.
5. Industrial buildings with rooftruss.
6. Todrawthe3Dviewofresidentialbuilding.

Total Hours: 30

TEXT BOOKS

1. CivilEngg.Drawing&Houseplanning– B.P.Verma,Khannapublishers,Delhi,1990
2. Buildingdrawing&detailing– Dr.Balagopal&T.S.Prabhu,Spadespublishers,Calicut,1989.

REFERENCES

1. 1.Buildingdrawing–Shah,TataMcGraw-Hill,NewDelhi,2000.
2. 2.Building planning & drawing – Dr. N.Kumaraswamy, A.Kameswara Rao, Charotarpublishing house.Mumbai,1997.

3.Shah,KaleandPatki,Buildingdrawing,TataMcGraw-HillNewDelhi,,1998.

Department of Computer Science and Engineering

Subject Code: BCE18OL2/ BCE20OL2	Subject Name : GEOGRAPHICAL INFORMATION SYSTEM AND MAPPING LAB	Ty/ Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: None	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Theexercisesaredesignedtogivepracticalexposuretothestudentstodatainput,datastorage
- Data analyses and data output capabilities of a standard GISsoftware.

COURSE OUTCOMES (COs) : (3- 5) At the end of the course, the student will be able to:

CO1	know about the basic principles of Building topology
CO2	know Basic commands of a onscreen digitilization
CO3	Acquire knowledge on generations of DEM
CO4	Be able to develop vector analysis and data output

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					2	2					
CO2	3					2	2					
C03	3					2	2					
C04	3					2	2					

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
C03	3	3	3	3
C04	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							√					

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

Subject Code: BCE18OL2 /BCE20OL2	Subject Name :	T y/ Lb/ ETL	L	T / S.Lr	P/ R	C
	GEOGRAPHICALINFORMATIONSYSTEMAND MAPPINGLAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Digitization - Point, Line, Polygon and SurfaceData
2. Buildingtopology–measuringdistanceandarea
3. Addingattributedata–queryingonattributedata
4. Onscreen digitization - Data Conversion – Vector to Raster, Rasterto Vector
5. Generation of DEM: from contours, spotheights
6. Vector Analysis – Buffering, Overlay and Networkanalysis
7. Data Output: Bar charts, Mapcompilation

Total Hours: 30

REFERENCES

1. QGIS-1.8-UserGuide,http://docs.qgis.org/pdf/QGIS-1.8-UserGuide-en.pdf,2013
2. Getting to Know ArcGIS for Desktop,ISBN: 97815894830882013
3. Understanding GIS: An ArcGIS Project Workbook, ISBN: 97815894824252011

Subject Code: BCE18OL3/ BCE20OL3	Subject Name: ENVIRONMENTALENGINEERING LABORATORY	Ty/Lb /ETL	L	T / S.Lr	P/ R	C

Department of Computer Science and Engineering

	Prerequisite: None	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL :

Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Toimpartknowledgeonpreparationofreagents,testingvariouswaterandwastewaterqualityparameters.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Togethand-onexperienceintheoperationofequipmentslikepHmeter,TDSmeter,turbiditymeter, etc.
CO2	To analyze water and wastewater volumetrically and using certain equipments
CO3	The students completing the course will be able to characterize wastewater and conduct treatability studies.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2		3		3	3	2		2	
CO2	3	2	2		3		3	3	2		2	
CO3	3	2	2		3		3	3	2		2	

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							√					

LIST OF EXPERIMENTS

1. a) Determination ofpH.
   b) Determination of Turbidity.
2. Determination ofHardness.
3. Determination ofAlkalinity.
4. Determination of ResidualChlorine.
5. Estimation ofChlorides.
6. Estimation of AmmoniaNitrogen.
7. Estimation ofSulphate.
8. Determination of optimumcoagulant dose.
9. Determination of specificconductivity.
10. EstimationofavailablechlorineinBleaching Powder.
11. Determination of dissolvedOxygen.
12. Determinationofsuspendedsettleable, volatileandfixed solids
13. B.O.D.Test.
14. C.O.D.Test.

REFERENCE BOOKS

1. Trivedi and Goel – Chemical and biological methods for waterpollution studies. New Delhi,2000.
2. A course Manual – Water and wastewater analysis. National Environmental Engineering Research Institute. Nagpur – publication.

Total Hours: 30

Department of Computer Science and Engineering

OPEN ELECTIVE CHEMICAL DEPARTMENT:

Subject Code: BCT18OE1/ BCT20OE1	**Subject Name : Fundamentals of Nanoscience**	**T y/ Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nanomaterial	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE:

- To enable the students to learn about basis of nanomaterial science, preparation method, types andapplication.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Will familiarize about the science of nanomaterials
CO2	Will develop knowledge in characteristic nanomaterial
CO3	Will demonstrate the preparation of nanomaterials

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	-	-	-	-	2	-	-	-	-	-
CO2	2	3	3	-	-	-	-	-	-	1	-	3
CO3	3	3	3	-	1	-	-	-	-	-	-	-

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**			
CO1	2	2	2	-			
CO2	3	1	3	-			
CO3	3	1	3	-			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	S o			
						√						

Department of Computer Science and Engineering

Subject Code: BCT18OE1/ BCT20OE1	Subject Name	T y/ Lb/ ETL	L	T / S.Lr	P/ R	C
	Fundamentals of Nanoscience	Ty	3	0/0	0/0	3

UNITI INTRODUCTION 9Hrs

Nanoscale Science and Technology- Implications for Physics, Chemistry,Biology and Engineering- Classifications of nanostructured materials- nanoparticles- quantum dots, nanowires-ultra-thinfilms- multilayered materials.Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNITII GENERAL METHODSOFPREPARATION 9Hrs

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication,Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition,MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNITIII NANOMATERIAL 9Hrs

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube,Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes,Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays functionalization and applications-Quantum wires, Quantum dots- preparation,properties and applications.

UNITIV CHARACTERIZATIONTECHNIQUE 9Hrs

xray diffraction technique, Scanning Electron Microscopy – environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA,SIMSNanoindentation.

UNITV APPLICATIONS 9Hrs

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging – Microelectro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition,Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

Total Hours: 45

TEXT BOOKS:

1.A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties andApplications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.

2.N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH,2000

REFERENCES:

1.G Timp (Editor), “Nanotechnology”, AIP press/Springer,1999.
2.Akhlesh Lakhtakia (Editor),“The Hand Book of NanoTechnology,Nanometer Structure, Theory,
Modeling and Simulations”.Prentice-Hall of India (P) Ltd, New Delhi,2007.

Department of Computer Science and Engineering

Subject Code: BCT18OE2/ BCT20OE2	Subject Name: Electrochemical Engineering	Ty / Lb/ ETL	L	T / SLr	P/ R	C
	Prerequisite: Moral science and general English	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- To solve problems related to the production, storage, distribution and utilization of electrochemical energy and the associated environmentalissues

COURSE OUTCOMES (COs) : (3- 5)

CO1	Student would be able to integrate professional, ethical, social and environmental factors in electrochemical engineering design and problem solving and understand the impact of these factors on global energy issues.
CO2	The students completing the course will be able to characterize electrodeposition and water corrosion

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	2	-	-	-	-	-	1
CO2	2	-	-	2	-	-	-	-	-	3	-	-

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	2	-	-				
CO2	2	1	-	-				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code: BCT18OE2/ BCT20OE2	Subject Name	Ty / Lb/ ETL	L	T / SLr	P/ R	C
	Electrochemical Engineering	Ty	3	0/0	0/0	3

UNITI **9Hrs**

Review basics of electrochemistry: Faraday's law -Nernst potential –Galvanic cells – Polarography, The electrical double layer: It's role in electrochemical processes –Electro capillary curve –Helmoltz layer –Guoy –Steven's layer

–fields at the interface.

UNITII **9Hrs**

Mass transfer in electrochemical systems: diffusion controlled electrochemical reaction –the importance of convention and the concept of limiting current. Over potential, primary-secondary current distribution –rotating discelectrode.

UNITIII **9Hrs**

Introduction to corrosion, series, corrosion theories derivation of potentialcurrent relations of activities controlled and diffusion controlled corrosion process. Potential-pH diagram, Forms of corrosion- definition, factors and control methods of various forms of corrosion-corrosion control measures industrial boiler water corrosion control – protective coatings –Vapor phase inhibitors –cathodic protection, sacrificialanodes

–Paint removers.

UNITIV **9Hrs**

Electro deposition –electro refining –electroforming –electro polishing –anodizing –Selective solar coatings, Primary and secondary batteries –types of batteries, Fuel cells.

UNITV **9Hrs**

Electrodes used in different electrochemical industries: Metals-Graphite –Lead dioxide –Titanium substrate insoluble electrodes –Iron oxide –semi conducting type etc. Metal finishing-cell design.types of electrochemical reactors, batch cell, fluidized bed electrochemical reactor, filter press cell, Swiss roll cell, plug flow cell, design equation, figures of merits of different type of electrochemical reactors.

TotalHours:45

TEXTBOOKS:

Eckenfelder, W. W, Jr. "Industrial Water Pollution Control" McGraw-Hill: New York,1966.
1. P. L. Ballaney, "Thermal Engineering", Khanna Publisher New Delhi,1986.
2. Perry R. H. Green D. W. "Perry's chemical Engineer's Handbook", McGraw Hill, New York,2007.

REFERENCES:

P. N. Ananthanarayan, “Basic Refrigeration & Air conditioning”, Tata McGraw Hill, New Delhi,2007

Department of Computer Science and Engineering

Subject Code: BCT18OE3/ BCT20OE3	Subject Name: Alternative Fuels And Energy Systems	Ty / Lb/ ETL	L	T / SLr	P/ R	C
	Prerequisite: Moral science and general English	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- To know about the types of alternative fuels and energy sources for ICengines.

COURSE OUTCOMES (COs) : (3- 5)

CO1	On completion of the course, the student will understand the various alternative fuels available, its properties, performance characteristics, combustion characteristics, emission characteristics, engine modifications required etc.,
CO2	Students can able to understand hoe to use hydrogen,]vegetable oils as fuels

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	2	-	-	-	-	-	1
CO2	2	-	-	2	-	-	-	-	-	3	-	-

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-
CO2	2	1	-	-

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

ubject Code: BCT18OE3/ BCT20OE3	Subject Name:	Ty / Lb/ ETL	L	T / SLr	P/ R	C
	Alternative Fuels And Energy Systems	Ty	3	0/0	0/0	3

UNIT I : ALCOHOLS AS FUELS 9Hrs

Introduction to alternative fuels. – Need for alternative fuels – Availability of different alternative fuels for SI and CI engines. Alcohols as fuels.Production methods of alcohols.Properties of alcohols as fuels.Methods of using alcohols in CI and SI engines. Blending, dual fuel operation, surface ignition and oxygenated additives. Performance emission and combustion characteristics in CI and SI engines.

UNIT II : VEGETABLE OILSASFUELS 9Hrs

Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Transesterification and emulsification of Vegetable oils – Performance in engines – Performance, Emission and Combustion Characteristics in dieselengines.

UNIT III : HYDROGEN ASENGINEFUEL 9Hrs

Production methods of hydrogen.Combustive properties of hydrogen. Problems associated with hydrogen as fuel and solutions. Different methods of using hydrogen in SI and CI engines.Performance, emission and combustion analysis in engines.Hydrogen storage – safety aspects of hydrogen.

UNIT IV : BIOGAS, NATURAL GAS AND LPGASFUELS 9Hrs

Production methods of Biogas, Natural gas and LPG.Properties studies. CO2 and H2S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines.

UNIT V : ELECTRIC, HYBRID AND FUELCELLVEHICLES 9Hrs

Layout of Electric vehicle and Hybrid vehicles – Advantages and drawbacks of electric and hybrid vehicles. System components, Electronic control system – Different configurations of Hybrid vehicles. Power split device. High energy and power density batteries – Basics of Fuel cell vehicles.

Text Book : Total Hours:45

1. Ayhan Demirbas, 'Biodiesel A Realistic Fuel Alternative for Diesel Engines', Springer-Verlag London Limited 2008.

REFERENCES:

1. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS Press Champaign, Illinois2005.
2. Richard L Bechtold P.E., Alternative Fuels Guide book, Society of Automotive Engineers, 1997 ISBN 0-76- 80-0052-1.

3. Transactions of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogasetc.).
4. Science direct Journals (Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy, etc.) onbiofuels.
5. Devaradjane. Dr. G., Kumaresan. Dr. M., "Automobile Engineering", AMK Publishers,2013.

Department of Computer Science and Engineering

Subject Code: BCT18OE4/ BCT20OE4	Subject Name: Petrochemical Unit Processes	Ty / Lb/ ETL	L	T / SLr	P/ R	C
	Prerequisite: Moral science and general English	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- To design and conduct experiments and analyze and interpret data related to petrochemical Unitprocesses.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Students would be able to understand the principles of various unit processes in the petrochemical industry.
CO2	Students will able to understand the production of steam reforming of Natural gas

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	2	-	-	-	-	-	1
CO2	2	-	-	2	-	-	-	-	-	3	-	-

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-
CO2	2	1	-	-

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code:	Subject Name:	Ty / Lb/ ETL	L	T / SLr	P/ R	C
BCT18OE4/ BCT20OE4	Petrochemical Unit Processes	Ty	3	0/0	0/0	3

UNITI FEED STOCK AND SOURCEOFPETROCHEMICALS 9Hrs

Overview of Petrochemical Industry – The key growth area of India, Economics – Feed stock selections for Petrochemicals – Steam cracking of Gas and Naphtha to produce Olefins, Diolefins and Production of Acetylene – Cracker product separation and BTX separation.

UNITII SYNTHESISGASPRODUCTION 9Hrs

Steam reforming of Natural gas – Naphtha and Heavy distillate to produce Hydrogen and Synthesis gas – Production of Methanol – Oxo process.

UNITIII UNITPROCESSES I 9Hrs

Fundamental and Technological principled involved in Alkylation – Oxidation – Nitration and Hydrolysis.

UNITIVUNITPROCESSESII 9Hrs

Fundamental and Technological principled involved in Sulphonation, Sulfation and Isomerisation.

UNITV UNITPROCESSESIII9Hrs

Fundamental and Technological principles involved in Halogenation and Esterification

Total Hours:45

TEXT BOOKS:

1. Bhaskara Rao, B.K., “A Text on Petrochemicals”, Khanna Publishers,2000.
2. Sukumar Maiti, “Indroduction to Petrochemicals”, 2nd Edition, Oxford and IBHPublishers,2002.

REFERENCES:

1. Margaret Wells, "Handbook of Petrochemicals and Processes", 2nd Edition, Ash GatePublishing Limited,2002.
2. Sami Matar, and Lewis F. Hatch., "Chemistry of Petrochemical Processes", 2nd Edition,Gulf Publishing Company, 2000.
3. Dryden, C.E., "Outlines of Chemical Technology", 2nd Edition, Affiliated East-WestPress,1993

Department of Computer Science and Engineering

Subject Code:	Subject Name: Principles of Desalination Technologies	Ty / Lb/ ETL	L	T / SLr	P/ R	C
BCT18OE5/ BCT20OE5	**Prerequisite: Moral science and general English**	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: Understand the techniques and technologies of desalination, Correlate the core curriculum to practical applications, Learn to select the right type of desalination system for a given location and purpose.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the relevance and need for desalination
CO2	Learn the science behind desalination

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	2	-	-	-	-	-	1
CO2	2	-	-	2	-	-	-	-	-	3	-	-

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	2	-	-				
CO2	2	1	-	-				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code:	Subject Name:	Ty / Lb/ ETL	L	T / SLr	P/ R	C
BCT18OE5/ BCT20OE5	Principles of Desalination Technologies	Ty	3	0/0	0/0	3

UNITI:INTRODUCTION9Hrs

Water Scenario around the world and India – need and relevance of desalination - water sources for desalination – typical seawater composition – brackish water compositional changes- contaminants: anthropogenic and geogenic- drinking water standards – WHO and Indian Standards – Mineral Water standards (indian). Desalination –meaning and description – relation to natural components of desalination - general descriptionminimum energy requirement – review of fundamentals of physical chemistry aspects relevant to desalination, solution properties – estimating the minimum energy requirement - based concept of de-mixing – exergy - estimation from colligative properties – Performance assessment parameters for desalination for thermal and membrane. Different types of Desalination techniques basic resources required for desalination – energy options – relative characteristics of different types of energy options.

UNIT II:MEMBRANEDESALINATION9Hrs

General features of Pressure Driven Membrane Processes – classification –Micro-filtration(MF) Ultrafiltration (UF), Nano-Filtration (NF) – pore-size – performance relationship. Pretreatment System – Need and relevance – different unit operations including membrane pretreatment (UF) – scaling calculations – dosing systems – treated water quality monitoring – SDI concept. Reverse Osmosis – basic principle – characteristics of membranes used – Nano-filtration – basic principle – comparative features of NF and RO – concentration polarization - transport mechanism and equations (no derivation required)- energy recovery. Performance characteristics of Reverse Osmosis and Nano-filtration – solute rejection - recovery- water flux – relationship amongst them –effect of temperature – performance of lab experiments – interpretation of lab data.- application of RO and NF for desalination.

UNIT III:THERMALDESALINATIO9Hrs

Basic Components of thermal Desalination – Heat Source – Sensible heat vs latent heat for use in desalination – features of isothermal and adiabatic processes. Thermodynamic properties – pressure vs temperature for steam, change of latent, Cp and BPE with temperature. – corrosion of materials and normal material of construction.Description of Flashing and Boiling: single effect evaporation and flashing – Need for multiple effects / stages – accessories for thermal desalination – ejectors – demisters - vacuum systems – pretreatment systems –Pumps. Principles of MSF/ MED : MED with TVC and MVC : Basic design considerations for thermal systems –operational features.

UNIT IV:NON CONVENTIONAL DESALINATION SYSTEMS 9Hrs

Membrane based Systems :Electrodialysis, Membrane. Distillation, Forward Osmosis.- Basic Principles – performance characteristics – Energy requirements – Challenges. Low temperature thermal desalination including ocean thermal energy and waste heat – Solar desalination including solar stills, solar thermal and solar photovoltaic– limitations and advantages. Hybrid Desalination systems, combined power and water dual purpose plants – examples of working desalination plants.

UNIT V: SOCIETAL, COMMERCIAL, ECONOMICS AND ENVIRONMENTAL ASPECTS 9Hrs

Selection of Desalination System – considerations based on capacity – local resources (including power, water etc.)– ultimate use– scale up – brackish water systems – considerations for societal cause / industrial water recycle. Economic Aspects of esalination – water cost calculation– capital cost/operating costs – feasibility analysis- Environmental issues –challenges – spent membrane, disposal- discharge concentrated stream – use of concentrate stream – recovery of values

Total Hours:45 Hrs

REFERENCES:

1 Fundamentals of Salt Water Desalination: Hisham T. El-Dessouky and Hisham M. Ettouney, ISBN:978-0-444- 50810-2 Elsevier(2009)

2 A Desalination Primer: Introductory Book for Students and Newcomers to Desalination :K.S.Spiegler and Y.M. El-Sayed, ISBN 086689 034 3, Desalination Publications Elsevier(1994)

Kirk &Othmer :Encyclopaedia of ChemicalTechnology

Subject Code: BCT18OE6/BCT20OE6	Subject Name : Piping Design Engineering	T y/ Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:
Credits T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE:

- To secure position of the Chief Piping Engineer in a reputed engineering firm where the sound technical experience and prowess in installation of piping can help in executing projects at a faster pace throughreduced costs.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Supervising team of designers and engineers to execute piping work as well as checking various details related to piping materials and its thickness .
CO2	Develop skill in Work analysis and material management that could help in efficient management of an enterprise.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	1	-	-	3	-	2	3	-	2
CO2	2	-	-	2	-	-	2	-	-	3	2	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-
CO2	3	1	3	-

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Catagory	Basic Sciences	Engineering Sciences	Humanities and Social	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code: BCT18OE6/ BCT20OE6	Subject Name :	T y/ Lb/ ETL	L	T / S.Lr	P/ R	C
	Piping Design Engineering	Ty	3	0/0	0/0	3

UNITI INTRODUCTION TOPIPINGENGINEERING 9Hrs

Fluid flow, types of fluids and examples, different pipe fittings. Friction factor, pressure drop for flow Newtonian and non-Newtonian fluids, pipe sizing, economic velocity.Pipe line networks and their analysis for flow in branches, restriction orifice sizing.Pressure drop calculations for non-Newtonian fluids.two phase flow, types of two phase flow, two phase flow as encountered in piping for steam, distillation column, pressure drop, vibrations in two phase flow.

UNITII MATERIALSFORPIPING 9Hrs

Selection of material for piping, desirable properties of piping materials, materials for various temperature and pressure conditions, materials for corrosion resistance. Common ASTM and IS specifications for: Seamless / ERW pipes, pipe fittings, flanges, and fasteners, materials for valves. Gaskets: Functions and properties, types of gaskets and their selection.

UNIT III CONTROL & SAFETYINPIPING 9Hrs

Types of valves, control valves, safety valves, constructional features, criteria for selection.Piping components, pressure relieving devices, constructional features, selection criteria and application, safety features. Calculations for line sizing, steam traps, P.R.V. & condensive systems.

UNITIV PIPINGSYSTEMDESIGN9Hrs

Design principles, calculation of pipe diameter, thickness, important system characteristics and design principles related to steam flow at high and low pressures. Design principles and line sizing for vacuum pipelines, slurry pipelines, surge drums and flare stacks, vacuum devices including ejector system. Considerations governing pump selection, analysis of system and pump characteristics in connection with series, parallel flow, and minimum flow and equalizing lines, NPSH, allowable nozzle loads in various codes. Design principles and line sizing of pneumatic conveying of solids, components of conveying systems, dust and fume extraction systemsprinciples.

UNITV INSULATION AND COSTINGOFPIPING9Hrs

Purposes of thermal insulation, principles of conductive and convective heat transfer to the extent of application to heat loss / gain through bare pipe surfaces. Critical thickness of insulation, estimating thickness of insulation, optimum thickness of insulation.Insulation for hot and cold materials and their important properties, insulation material selection criteria, typical insulation specification – hot and cold materials. Introduction to P & I Diagrams, Process flow diagrams, standard symbols and notations. Introduction to various facilities required guidelines for Plot Plan / Plant Layout. Introduction to equipment layout, piping layout, piping isometrics and bill of material. Typical piping system layout considerations for following systems: (i) Distillation columns andheatexchangers,(ii)Reactors,(iii)Piperacks,(iv)Storagetanks,(v)Pumps

Total Hours: 45

REFERENCE BOOKS:

1. Piping Design Handbook by John J. Mcketta, by Marcel Dekker, Inc, NewYork.
2. Process plant layout and piping design by Ed Bausbacher & Roger Hunt (PTK Prentice HallPublication)
3. Piping Handbook, Edited by Mohinder Nayyar, McGraw-HillEducation
4. Pipe Drafting and Design by Roy A Parisher & Robert A. Rhea. ASME Codes31

Department of Computer Science and Engineering

Subject Code: BCT18OE7/BCT20OE7	Subject Name : E-Waste Management	T y/ Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R :
Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE:

- To secure position of the Chief Piping Engineer in a reputed engineering firm where the soundtechnical experience and prowess in installation of piping can help in executing projects at a faster pace through reduced costs.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Supervising team of designers and engineers to execute piping work as well as checking various details related to piping materials and its thickness .
CO2	Develop skill in Work analysis and material management that could help in efficient management of an enterprise.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	1	-	-	3	-	-	3	-	2
CO2	2	3	-	2	-	-	2	-	-	3	3	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-
CO2	3	1	3	-

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	S o			

						√						

Department of Computer Science and Engineering

Subject Code: BCT18OE7/ BCT20OE7	Subject Name	T y/ Lb/ ETL	L	T / S.Lr	P/ R	C
	E-Waste Management	Ty	3	0/0	0/0	3

UNITI INTRODUCTION6Hrs

Composition – e-waste generation in global context – growth of electrical and electronic industry- Environmental concerns.- Effects on Environment and Human Health.

UNITIITHEBASELCONVENTION 12Hrs

Compliance and implementation- Scheme to control the movement of hazardous waste - Technical assistance offered by the Convention -Other important highlights of the Basel Convention - Waste Electrical and Electronic Equipment (WEEE)- Obligations of the producer under the WEEE.

UNITIII MANAGEMENTE-WASTE 9Hrs

Hazardous waste isolation- Guidelines for environmentally sound management- compliance and implementation – inventory management- reduction- process modification- volume reduction- recovery and reuse- Concerns/ Challenges for e-waste management

UNITIV RECYCLINGE-WASTE 12Hrs

Global trade in hazardous waste - Rising illegal e-waste exports - Main factors in global waste trade economy Waste trading as a quintessential part of electronic recycling - Free trade agreements as a means of waste trading Import of hazardous e-waste - Porous ports and lack of checking facilities - Illegal waste imports seized in ports

UNITV RECOMMENDEDOPTIONS 6Hrs

Creating awareness-Training for the management and minimization of hazardous wastes –sustainable product design –role of government – Responsibility of Industries andpublic.

Total Hours: 45

REFERENCES:

1. K. Satyamurty, 'Managing e-waste without harming environment', The Hindu, 03 April,2006.
2. Marwaan Macan- Markar, 'Free Trade Cannot Include Toxic Waste', Toxic Trade News, Basel Action Network (BAN), February, 2007.
3. Freeman M. H. 1989. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Company.

Department of Computer Science and Engineering

OPEN ELECTIVE- ELECTRICAL AND ELECTRONICS ENGINEERING

Subject Code: BEE18OE1/ BEE20OE1	Subject Name: ELECTRICAL SAFETY FOR ENGINEERS	Ty/Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	T	3	0	0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE:

- To attain knowledge on ElectricalSafety
- To know about the operation of Electrical SafetyEquipments
- To learn about the safetyprocedures
- To know about the electrical safetycodes
- To train the students on the Safetytraining.

COURSE OUTCOMES (Cos): (3-5)

CO1	Attained knowledge on the basics of Electrical Safety
CO2	Knowledge about the operation of the Safety equipments
CO3	Knowledge on the safety procedures
CO4	Familiarity on the electrical safety codes
CO5	Ability to become consultant and to attend the Vendors.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	1	3	3	2	2	1	2	2
CO2	3	3	1	2	2	3	3	3	2	2	3	3
CO3	2	2	2	3	1	2	2	2	3	2	2	1
CO4	3	1	3	2	2	1	1	1	1	3	1	2
CO5	1	2	2	1	3	2	2	2	2	2	2	2

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	3	2	2	2			
CO2	3	2	2	2			
CO3	2	3	3	1			
CO4	3	2	2	2			
CO5	2	1	2	2			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						
Approval												

Subject Code: BEE18OE1/ BEE20OE1	**Subject Name:**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P / R**	**C**
	ELECTRICAL SAFETY FOR ENGINEERS	T	3	0	0	3

UNIT I HAZARDSOF ELECTRICITY 9Hrs

Introduction – Hazards Analysis – Shock – Shock Effect – Arc –arc energy release-Arc energy-Arcing voltage-Arc surface Area-Incident Energy-Arc Flash Effect – Blast – Affected body parts – Summary of causes –Injury and Death – Protective Strategies.

UNIT II ELECTRICALSAFETYEQUIPMENT 9 Hrs

General Inspection and Testing Requirement for Electrical Safety Equipment – Flash and Thermal Production – Head and Eye Protection – Rubber Insulating Equipment –Hot Sticks-Barrier and signs- Insulated Tools –Safety Grounding Equipment – Electricians Safety Kit.

UNIT III SAFETYPROCEDURES ANDORGANIZATIONALMETHODS 9Hrs

Six Step Safety Methods – Safe Switching of Power System – Voltage measurement Techniques – Placement of Safety Grounds – Tools And Test Equipment – One Minute Safety Audit-Electrical Safety program Development – Employee Electrical Safety Teams – Safety Meetings – Outage Reports – Safety Audits.

UNIT IVREGULATORY AND LEGAL SAFETY REQUIREMENTS ANDSTANDARDS 9Hrs

Regulatory Bodies-ANSI-IEEE-Electrical safety code –Standards for Electrical safety in the workplace- Accident prevention-first aid –Rescue Techniques-accident invention.

UNIT V SAFETY TRAINING METHODSANDSYSTEMS9Hrs

Introduction – Elements of a good Training Program – On the Job Training – Training Consultants and Vendors-Training Program Setup – Step by Step Method

Total hours: 45

Text Book:

1. Electrical safety handbook - john cadick - McGRAW-HILL, Third Edition

Department of Computer Science and Engineering

Subject Code: BEE18OE2/BEE 20OE2	Subject Name: ENERGY CONSERVATION TECHNIQUES	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study about introduction to the Energy ConservationTechnology
- To know the working Principle of energyconservation
- To impart knowledge on energyefficiencies
- To analyse various economicaspects
- To have a wide spread knowledge on advancedtopics

COURSE OUTCOMES (COs) : (3- 5)

CO1	Attain Knowledge on Energy Conservation Technology
CO2	Knowledge on the working principle of energy conservation
CO3	Knowledge on energy efficiencies
CO4	Ability to analyse various economic aspects
CO5	Knowledge on advanced topics

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	2	2	2	1	3	3	2
CO2	3	2	2	2	2	2	2	2	2	3	2	2
CO3	3	3	2	2	2	2	2	2	2	2	2	1
CO4	2	1	1	1	2	3	2	3	1	1	2	1
CO5	3	1	2	2	1	1	3	2	3	2	3	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1
CO2	2	2	1	2
CO3	2	1	2	3
CO4	2	2	2	2
CO5	2	3	3	2

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code: BEE18OE2/ BEE20OE2	Subject Name:	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	ENERGY CONSERVATION TECHNIQUES	Ty	3	0/0	0/0	3

UNITI INTRODUCTION 9Hrs

Historical uses–Components of the energy conseervation system – Power output from an ideal system –

Power output from practical system

UNIT IIENERGYCONSERVATION 9Hrs

Principle of energy conservation - waste heat recovery - Heat pump – Economics of energy conservation, cogeneration, combined cycle plants, electrical energy conservation opportunities

UNIT IIIENERGYEFFICIENCIES 9Hrs

Efficiencies- Rate Processes in Energy Conversion- Energy Conversion Reactions- Energy Conversion Devices and Their Efficiency- Heat Transfer Devices and Their Efficiency- Deviations from the Ideal and Component Efficiencies

UNIT IVECONOMICASPECTS 9 Hrs

Economics of power factor improvement – power capacitors – power quality. Importance of electrical energy conservation – methods – energy efficient equipments.Introduction to energy auditing.

UNIT V ADVANCED TOPICS 9Hrs

Introduction to energy auditing- Other conversion technologies- Modeling of micro-grids and distributed generation system- Energy source and energy yield of wind turbine generators- Interfacing issues of renewable energy system to conventional power grid **Total hours: 45**

Text books:

1. Manwell, J.F. Mcgowan, J.G. Rogers, A.L.(2002) Wind Energy Explained – Theory, Design & Application. John Wiley &Sons
2. Gray L. Johnson,(1985) Wind Energy Systems. Prentice HallInc

Reference books:

1. Epenshaw Taylor, (2009) Utilization Of Electric Energy. 12th Impression. UniversitiesPress
2. Wadhwa, C.L. (2003) Generation, Distribution and Utilization of Electrical Energy. NewAge International Pvt. Ltd

Department of Computer Science and Engineering

Subject Code: BEE18OE3/ BEE20OE3	Subject Name: ELECTRIC VEHICLE TECHNOLOGY	Ty/Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Ty	3	0	0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- To study about Electric VehicleTechnology
- To study the concept of Microgrid and the controlmodes
- To impart knowledge on DistributedGeneration
- To analyse the impact of GridIntegration.
- To understand various power quality issues and the protection schemes forMicrogrid.

COURSE OUTCOMES (Cos): (3-5)

CO1	Understanding of various conventional and Nonconventional source of energy resources
CO2	Familiar to Electric Vehicles and the control modes
CO3	knowledge on Hybrid Vehicle
CO4	Familiar to Grid Integration
CO5	Acquire knowledge on various power quality issues and the protection schemes in Electric Vehicle

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	2	2	1	3	2	2	3	2
CO2	2	1	3	3	1	2	1	3	3	1	3	3
CO3	3	2	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	1	3	2			
CO2	2	1	3	3			
CO3	3	2	3	3			
CO4	3	3	3	3			
CO5	3	3	3	3			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Department of Computer Science and Engineering

Subject Code: BEE18OE3/ BEE20OE3	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	ELECTRIC VEHICLE TECHNOLOGY	T	3	0	0	3

UNITI:INTRODUCTION 9 Hrs

Advanced Energy Storage Systems - Types of PEVs - Charging Techniques - V2G and G2V - Alternative Fuel and HEV Vehicle Technology

UNIT II:AUTOMOTIVESYSTEMS 9 Hrs

Introduction to today's automobiles – Basic Automotive Components - A working knowledge of basic automotive components - general maintenance necessary for vehicle operations f

UNIT III: ELECTRIC & HYBRID VEHICLETECHNOLOGY1 9Hrs

Fundamentals of Electric and Gas-Electric Hybrid Vehicles - EV and HEV batteries, Fuel Cells, Electric Motor Controllers Invertors - AuxiliaryAccessories

UNIT IV: ELECTRIC & HYBRID VEHICLETECHNOLOGY2 9 Hrs

Battery Electric Vehicles (BEV) - Hybrid Electric Vehicles (HEV) - Plug-in Hybrid Electric Vehicles (PHEV) – Trouble Shooting PHEVTechnologies

UNIT V: EV DATA ACQUISITION &CONTROLSYSTEMS 9 Hrs

Vehicle Network Theory, Vehicle Embedded Controllers - Communications Protocols - Sensors, Actuators – Internal Combustion in Electric Assist Vehicles - Vehicle Emissions - Emission Control Systems - PowerControl

Total Hours: 45

REFERENCE BOOKS:

1. SumedhaRajakaruna, FarhadShahnia, Arindham Ghosh, "Plug-in-ElectricVehicles in SmartGrid – Integration Techniques", Springer,2015
2. SumedhaRajakaruna, FarhadShahnia, Arindham Ghosh "Plug-in-ElectricVehicles in SmartGrid – Integration Techniques – Energy Management", Springer,2015
3. SumedhaRajakaruna, FarhadShahnia, Arindham Ghosh, "Plug-in-ElectricVehicles in SmartGrid

– Charging Strategies", Springer,2015

Department of Computer Science and Engineering

Subject Code: BEE18OE4/ BEE20OE4	Subject Name: BIOMEDICAL INSTRUMENTATION	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Ty	3	0	0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- Thestudentwillstudyaboutcommunicationmechanicsinabiomedicalsystemwithfewexamples
- The student will acquire basic knowledge in life assisting and therapeuticdevices

COURSE OUTCOMES (Cos): (3-5)

CO1	The graduate is capable of knowing the human physiology.
CO2	The graduate will be able to study about communication mechanics in a biomedical system with few examples
CO3	Understands the basic principles in imaging techniques
CO4	Acquires basic knowledge in life assisting and therapeutic devices
CO5	Familiar with Bio medical instruments

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	2	2	1	3	2	2	3	2
CO2	2	1	3	3	1	2	1	3	3	1	3	3
CO3	3	2	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	1	3	2			
CO2	2	1	3	3			
CO3	3	2	3	3			
CO4	3	3	3	3			
CO5	3	3	3	3			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code: BEE18OE4/ BEE20OE4	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	BIOMEDICAL INSTRUMENTATION	Ty	3	0	0	3

UNIT I: ANATOMY, PHYSIOLOGYANDTRANSDUCERS **9Hrs** Brief review of human physiology and anatomy – cell and their structures – electrical mechanical and chemical activities – action and resting potential – different types of electrodes – sensors used in biomedicine – selection criteria for transducers and electrodes – necessity for low noise pre-amplifiers– difference amplifiers – chopper amplifiers – electrical safety – grounding andisolation

UNIT II: ELECTRO –PHYSIOLOGICALMEASUREMENT **9Hrs**

ECG – EEG – EMG– lead system and recording methods – typical waveforms

UNIT III: NON – ELECTRICALPARAMETERMEASUREMENT **9Hrs**

Measurement of blood pressure – blood flow cardiac output – cardiac rate – heart sound measurement of gas volume – flow rate of CO_2 and O_2 in exhaust air – PH ofblood

UNIT IV: MEDICAL IMAGINGPARAMETERMEASUREMENTS **9Hrs**

X-RAY machine – computer tomography – magnetic resonance imaging system – ultra sonography – endoscopy – different types of telemetry system – laser inbiomedicine.

UNIT V: ASSISTING ANDTHERAPEUTICDEVICES **9Hrs**

Cardiac pacemakers – defibrillators ventilators – muscle stimulators – diathermy – introduction to artificial kidney artificial heart – heart lung machine – limb prosthetics– elements of audio and visual aids.

Total Hours: 45

Text Books

1. Webster, J.G. (1999) Medical Instrumentation: Application and Design.3rd Ed. John Wiley andSon.
2. Khandpur R.S.(1987) Hand book of Biomedical Instrumentation and Measurements. New Delhi: Tata McGraw-Hill.

References

1. Geddes and Baker, (1975) Principles of Applied Biomedical Instrumentation. USA:John Wiley and Sons.
2. Well, G.(1980) Biomedical Instrumentation and Measurements. New Jersey: PrenticeHall.
3. Koryla, J. (1980) Medical and Biological Application of electro chemical devices. Chichester: John Wiley andSons.

4. Wise, D. L. (1989) Applied Bio- sensors,Butterworth.USA:

Department of Computer Science and Engineering

Subject Code: BEE18OE5/ BEE20OE5	Subject Name: INTRODUCTION TO POWER ELECTRONICS	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Ty	3	0	0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- Togetanoverviewofdifferenttypesofpowersemi-conductordevicesandtheirswitching characteristics.
  To understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the operation, switching techniques and basic topologics of DC-DC switchingregulators
- Tolearnthedifferentmodulationtechniquesofpulsewidthmodulatedinvertersandto understand the harmonic reductionmethods
- To study the operation of AC voltage controller and Matrixconverters

COURSE OUTCOMES (Cos): (3-5)

CO1	Understanding of characteristics of power semi –conductors
CO2	Capable of understand operation of controlled rectifiers.
CO3	Capable of understand operation of Choppers.
CO4	Capable of understand operation of PWM Inverters
CO5	Capable of understand operation of AC voltage controller and Matrix converters.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	2	2	2	2	2	2	3	2
CO2	2	1	2	3	1	1	3	1	3	1	2	3
CO3	3	2	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	3	3

Cos / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	2
CO2	2	1	3	3
CO3	3	2	1	3
CO4	3	3	1	3
CO5	3	3	2	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

						>						

Department of Computer Science and Engineering

Subject Code: BEE18OE5/ BEE20OE5	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	INTRODUCTION TO POWER ELECTRONICS	Ty	3	0	0	3

UNIT I POWERSEMI-CONDUCTORDEVICES **9 Hrs**

Study of switching devices, - Frame, Driver and snubber circuit of SCR, TRIAC,BJT, IGBT, MOSFET,-

Turn-on and turn-off characteristics, switching losses, Commutation circuits for SCR, IGBT.

UNIT IIPHASE-CONTROLLEDCONVERTERS **9 Hrs**

2-pulse, 3-pulse and 6-pulse converters – Effect of source inductance – performance parameters – Reactive power control of cnverters – Dual converters - Battery charger.

UNIT III DC TODCCONVERTER **9Hrs**

Step-down and step-up chopper - Time ratio control and current limit control – Buck, boost, buckboost converter, concept of Resonant switching - SMPS.

UNITIVINVERTERS **9 Hrs**

Single phase and three phase (both 1200 mode and 1800 mode) inverters -PWM techniques: Sinusoidal PWM,modifiedsinusoidalPWM -multiplePWM – Introductiontospacevectormodulations-Voltage and harmonic control - Series resonant inverter - Current sourceinverter.

UNIT V AC TOACCONVERTERS **9Hrs**

Single phase AC voltage controllers – Multistage sequence control - single and three phase cycloconverters –Introduction to Integral cycle control, Power factor control and Matrix converters.

Total hours: 45

TEXT BOOKS

1. M.H. Rashid, ‘Power Electronics: Circuits, Devices and Applications’, Pearson Education, PHI Third edition, New Delhi2004.
2. Philip T.Krein, “Elements of Power Electronics” Oxford University Press, 2004Edition.

REFERENCES

1. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint,2003.

2. P.S.Bimbra “Power Electronics” Khanna Publishers, third Edition2003.
3. NedMohan,Tore.M.Undeland,William.P.Robbins,‘PowerElectronics: Converters,Applications and Design’, John Wiley and sons, third edition,2003.

Department of Computer Science and Engineering

Subject Code: BEE18OE6/ BEE20OE6	Subject Name: INDUSTRIAL INSTRUMENTATION	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Ty	3	0	0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- To know about force, torque,velocity
- To learn the measurement of acceleration, vibration, density andviscosity
- To understand the Pressure and Temperaturemeasurement

COURSE OUTCOMES (Cos): (3-5)

CO1	Attain knowledge on Force, Torque and velocity
CO2	Ability to measure the acceleration, vibration etc
CO3	Capable to use the techniques for temperature and pressure measurement
CO4	Attain knowledge on Thermocouple and pyrometers
CO5	Ability to work in an Instrumentation Industry

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	2	2	1	3	2	2	3	2
CO2	2	1	3	3	1	2	1	3	3	1	3	3
CO3	3	2	3	3	3	3	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	1	3	2			
CO2	2	1	3	3			
CO3	3	2	3	3			
CO4	3	3	3	3			
CO5	3	3	3	3			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code: BEE18OE6/ BEE20OE6	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	INDUSTRIAL INSTRUMENTATION	Ty	3	0	0	3

UNIT I: MEASUREMENT OF FORCE, TORQUEANDVELOCITY9Hrs Electric balance – Different types of load cells – Magnets – Elastic load cells - Strain gauge load cell – Different methods of torque measurement – Strain gauge, relative regular twist – Speed measurement – Revolutioncounter

UNIT II:MEASUREMENT OF ACCELERATION, VIBRATION,DENSITYANDVISCOSITY9Hrs

Accelerometers – LVDT, piezoelectric, strain gauge and variable reluctance type accelerometers – Mechanical type vibration instruments – Calibration of vibration pick-ups – Units of density, specific gravity and viscosity used in industries – Types of density meter – Viscosityterms – Saybolt viscometer– Rotameter type.

UNIT III:PRESSUREMEASUREMENT 9Hrs

Unitsofpressure-Manometers–Differenttypes–Elastictypepressuregauges–Bourdontypebellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.

UNIT IV:TEMPERATUREMEASUREMENT9Hrs

Definitions and standards – Primary and secondary fixed points – Calibration of thermometer, different types of filled in system thermometer – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement

UNIT V: THERMOCOUPLESANDPYROMETERS 9Hrs

Thermocouples – Laws of thermocouple – Fabrication of industrial thermocouples – Signal conditioning of thermocouples output – Thermal block reference functions – Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two colour radiation pyrometers.

Total Hours: 45

Text Books

1. Doebelin, E.O.(2003) Measurement Systems – Application and Design. Tata McGraw Hill
2. Jain, R.K. (1999) Mechanical and Industrial Measurements. New Delhi: KhannaPublishers.

References

1. Patranabis,D.(1996)PrinciplesofIndustrialInstrumentation.TataMcGrawHillPublishingCompany
2. Sawhney, A.K. and Sawhney, P.(2004) A Course on Mechanical Measurements, Instrumentation

and Control Dhanpath Rai andCo.

3. Nakra, B.C. &Chaudary, B.C.Instrumentation Measurement &Analysis.Tata McGraw Hill
4. Singh, S.K.(2003) Industrial Instrumentation and Control.Tata McGrawHill.
5. Eckman, D.P. Industrial Instrumentation. Wiley EasternLtd.

Department of Computer Science and Engineering

Subject Code: BEE18OE7/ BEE20OE7	Subject Name: SOLAR ENERGY CONVERSION SYSTEM	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Ty	3	0	0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- To study about Solar Radiation and the collectortypes
- To impart knowledge on the Application of Solar thermalTechnology
- To understand the fundamentals of Solar Photovoltaiccells
- To design the Solar cells in cost effectivemanner.
- To learn about the solar passiveArchitecture

COURSE OUTCOMES (Cos): (3-5)

CO1	Students understand Solar Radiation and the collector types
CO2	Acquire knowledge on the Application of Solar thermal Technology
CO3	Understand the fundamentals of Solar Photovoltaic cells
CO4	Familiar to design the Solar cells in cost effective manner
CO5	Incorporate the knowledge about the solar passive Architecture

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	2	2	2	3	2
CO2	3	3	3	3	3	3	3	2	2	2	3	2
CO3	3	3	3	3	3	3	3	2	2	2	3	2
CO4	3	3	3	3	3	3	3	2	2	2	3	2
CO5	3	3	3	3	3	3	3	2	2	2	3	2

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	3	3	3			
CO2	2	3	3	3			
CO3	2	3	3	3			
CO4	2	3	3	3			
CO5	2	3	3	3			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code: BEE18OE7/ BEE20OE7	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	SOLAR ENERGY CONVERSION SYSTEM	Ty	3	0	0	3

UNIT I SOLAR RADIATIONANDCOLLECTORS **9 Hrs**

Solar Radiation- Solar angles - Sun path diagrams - shadow determination – Solar Collectors - flat plate collector thermal analysis - heat capacity effect - testing methods-evacuated tubular collectors - concentrator collectors

UNIT II APPLICATIONS OF SOLARTHERMALTECHNOLOGY **9 Hrs**

Principle of working, types - design and operation of - solar heating and cooling systems - solar water heaters – thermal storage systems – solar still – solar cooker – domestic, community – solar pond – solar drying

UNIT III SOLARPVFUNDAMENTALS **9Hrs**

Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination characteristics - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells

UNIT IV SOLAR PHOTOVOLTAIC SYSTEM DESIGNANDAPPLICATIONS **9Hrs**

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization -voltage regulation - maximum tracking – use of computers in array design - quick sizing method - array protection and troubleshooting - stand alone

UNIT V SOLARPASSIVEARCHITECTURE **9 Hrs**

Thermal comfort - heat transmission in buildings- bioclimatic classification – passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. – energy efficient landscape design

Total Hours: 45

Text Books:

1. Sukhatme S P, (1984), Solar Energy, Tata McGrawHill
2. Kreider, J.F. and Frank Kreith, (1981), Solar Energy Handbook, McGrawHill
3. Goswami, D.Y., Kreider, J. F. and & Francis.,(2000),Principles of SolarEngineering

Reference Books:

1. Garg H P., Prakash J., (2000), Solar Energy: Fundamentals & Applications, Tata McGrawHill
2. Duffie, J. A. and Beckman, W. A., (1991), Solar Engineering of Thermal Processes, JohnWiley
3. Alan L Fahrenbruch and Richard H Bube, (1983), Fundamentals of Solar Cells: PV Solar Energy Conversion, AcademicPress
4. Larry D Partain,(1995), Solar Cells and their Applications, John Wiley and Sons,Inc.

Department of Computer Science and Engineering

Subject Code: BEE18OE8/BEE20OE8	Subject Name: WIND ENERGY CONVERSION SYSTEM	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Ty	3	0	0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- To know the basics of Wind Energy ConversionSystem
- To solve the Energycrisis.
- To know the Power Electronic Devices and itscharacteristics.
- To understand differentconverters
- To design wind Energy conversion system such as subsystems and itscomponents

COURSE OUTCOMES (Cos): (3-5)

CO1	Knowledge on Wind Energy Systems
CO2	Capability to find solution for Energy Crisis
CO3	Attained knowledge on various types of converters
CO4	Familiarity in Power Electronics Devices and its performance.
CO5	Ability to design Electrical Machines for Wind Energy Conversion System

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	2	3	2	1	1	3	3	1
CO2	2	3	3	3	3	3	3	3	2	2	3	3
CO3	3	2	2	3	2	3	2	2	2	1	3	2
CO4	2	2	2	2	1	3	2	2	3	2	3	1
CO5	3	3	3	3	3	3	2	3	3	2	3	2

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	1	1	2			
CO2	1	3	2	3			
CO3	1	2	3	2			
CO4	2	2	3	2			
CO5	3	3	3	3			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

						>						

Department of Computer Science and Engineering

Subject Code: BEE18OE8 /BEE20OE8	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	WIND ENERGY CONVERSION SYSTEM	Ty	3	0	0	3

UNIT I INTRODUCTION TOWINDSYSTEMS 9Hrs

Historical uses of wind – History of wind turbines – Horizontal axis wind turbines – Darreius Wind Turbines – Innovative wind turbines – Components of the wind energy conversion system – Power output from an ideal wind turbine – Power output from practical wind turbines

UNIT II WIND CHARACTERISTICS&MEASUREMENTS 9Hrs

Meteorology of wind – Wind speed statistics – Weibull Statistics – Rayleigh and normal distribution– Windmeasurements–Eolianfeatures–BiologicalIndicators–Typesofanemometersandtheiroperation – Wind direction – Wind measurements with balloons

UNIT III WIND TURBINE SUBSYSTEMS&COMPONENTS 9Hrs

Rotor – Blades – Aerodynamic design – Structural Design – Fabrication – Aerodynamic ControlSurfaces – Hub – Types- Drive Train – Coupling – Gearbox – Brake – Types – Main frame & Nacelle – Tower

UNIT IV ELECTRICAL MACHINESFORWECS 9Hrs

Induction Machine – Theory of IM operation - Dynamic dq Modeling - Doubly fed Induction Generator – Synchronous Machines – Theory of operation – Starting wind turbines with IG - Variable Reluctance Machine – Effect of Harmonics

UNIT V OVERVIEWOFCONVERTERS 9 Hrs

Six Pulse Converter – 12 Pulse Converter – Sequential control of converters – Converter Control – EMI and Power Quality Problems – Control of Cycloconverter – Matrix Converters – High Frequency Cycloconverter, VFC and CFC

Total Hours: 45

Text books:

1. Manwell, J.F. Mcgowan, J.G. Rogers, A.L.(2002) Wind Energy Explained – Theory, Design & Application. John Wiley &Sons
2. Gray L. Johnson,(1985) Wind Energy Systems. Prentice HallInc
3. Bose, B.K. (2001) Modern Power Electronics & AC Drives. PrenticeHall

Reference Books:

1. Vaughn Nelson, (2009) Wind Energy – Renewable Energy & the Environment. CRC Press

Department of Computer Science and Engineering

Subject Code: BEE18OE9/ BEE20OE9	Subject Name: ENERGY STORAGE TECHNOLOGY	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Ty	3	0	0	3

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE:

- To study about the Energy StorageTechnology
- To know the working Principle of Batteries and itstypes
- To impart knowledge on Fuel Cells along with its advantage anddisadvantages
- To analyse various types of energy storagedevices.
- To have a wide spread knowledge on ElectricVehicle

COURSE OUTCOMES (Cos): (3-5)

CO1	Attain Knowledge on Energy Storage Technology
CO2	Knowledge on the working principle of batteries and its types
CO3	Knowledge n Fuel cells
CO4	Ability to analyse various types of energy storage devices
CO5	Knowledge on Electric vehicles

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	2	2	2	1	3	3	2
CO2	3	2	2	2	2	2	2	2	2	3	2	2
CO3	3	3	2	2	2	2	2	2	2	2	2	1
CO4	2	1	1	1	2	3	2	3	1	1	2	1
CO5	3	1	2	2	1	1	3	2	3	2	3	1

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	3	3	2	1			
CO2	2	2	1	2			
CO3	2	1	2	3			
CO4	2	2	2	2			
CO5	2	3	3	2			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences and Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
			√								

Subject Code: BEE18OE9/ BEE20OE9	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	ENERGY STORAGE TECHNOLOGY	Ty	3	0	0	3

UNITI INTRODUCTION TOENERGYSTORAGE 9Hrs

Energy storage – Utilization of Energy storage devices - Need for Energy Storage – Types of energy Storage – Comparison of Energy Storage technologies – Applications.

UNITII ELECTRICALENERGYSTORAGE 9Hrs

Concept of batteries – Measurement of Battery performance – Charging and Discharging- Storage Density – Safety issues. Types of Batteries – Lead Acid, Nickel-Cadmium, Zinc manganese dioxide and modern batteries- Zinc Air, Nickel Hydride, lithiumbattery.

UNITIII FUELCELL 9Hrs

Fuel Cell – History of fuel cell – Principle of electrochemical Storage – Types – Hydrogen oxygen cells, Hydrogen air cell – Hydrocarbon air cell –alkaline fuel cell – detailed analysis – advantage and drawback of each cell.

UNIT IV ALTERNATE ENERGYSTORAGETECHNOLOGIES 9Hrs

Solar Photovoltaics – Wind Power - Flywheel – Super Capacitors – Principles & applications, Compressed Air Energy Storage- Concept of Hybrid Storage -Applications

UNIT V ELECTRICVEHICLE 9Hrs

ElectricVehicle–Types–HybridVehicle–BatteringCharging–UsageofbatteriesinHybridvehicle–

Fundamentals of Electric vehicle modeling - EV and the Environment – Pollution effect.

Total Hours: 45

Text Books:

1. IbrabimDincer, marc A,Rosen, (2011) Thermal Energy Storage Systems and Applications, 2nd Ed, JohnWiley
2. James Larminie, John Lowry (2003), Electric Vehicle Technology Explained, John Wiley &Sons

References

1. Seth Leitman, Bob Brant (2013) Build Your Own Electric Vehicle, 3rd Ed, McGrawHill
2. James larminie, Andrew Dicks, (2003), Fuel Cell Systems Explained,Wiley

Department of Computer Science and Engineering

Subject Code: BEE18OL1/ BEE20OL1	Subject Name: TRANSDUCER LAB	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE:

- To learn practically about transducers and about the types ofTransducers
- To study various transducers used for the measurement of various physicalQuantities
- To identify suitable instruments to meet the requirements of industrialapplications
- To measure Resistive, Capacitive and Inductivetransducers
- To calibrate varioustransducers

COURSE OUTCOMES (Cos): (3-5)

CO1	Enables the students to practically know about transducers and about the types of Transducers
CO2	various transducers used for the measurement of various physical Quantities
CO3	The student can identify suitable instruments to meet the requirements of industrial applications
CO4	The graduate can measure Resistive, Capacitive and Inductive transducers
CO5	Graduate can calibrate various transducers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	3	3	2	2	1	3	2	3	2
CO2	3	3	3	3	2	2	1	1	2	3	2	1
CO3	3	2	2	2	2	1	2	2	3	3	2	1
CO4	2	3	3	2	3	2	3	3	3	2	1	2
CO5	3	3	3	3	1	2	1	2	3	3	2	1

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	2	3	3			
CO2	3	3	3	2			
CO3	3	3	3	2			
CO4	3	3	2	3			
CO5	2	2	3	1			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Department of Computer Science and Engineering

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						
Approval												

Department of Computer Science and Engineering

Subject Code: BEE18OL1/ BEE20OL1	Subject Name:	Ty/Lb/ ETL	L	T / S.Lr	P / R	C
	TRANSDUCER LAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Displacement versus output voltage characteristics of a Potentiometrictransducer.
2. Strain gaugecharacteristics.
3. Load cellcharacteristics.
4. Photoelectrictachometer.
5. Hall effecttransducer.
6. Characteristics ofLVDT.
7. Characteristic of LDR, Thermistor andthermocouple.
8. Ramp response characteristic of filled in systemthermometer.
9. Step response characteristic of RTD andthermocouple.
10. Flapper nozzle system.
11. P/I and I/Pconverters.
12. Study of smarttransducers

Total Hours: 45

Subject Code: BEE18OL2/ BEE20OL2	Subject Name: PLC AND SCADA	Ty / Lab ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the programming inPLC.
- The students will be able to understand various faults usingSCADA.

COURSE OUTCOMES (COs) : (3- 5)

CO 1	Acquire programming knowledge in PLC
CO 2	Student can understand various faults using SCADA

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	3	3	3	2	1	3	1	3	1
CO 2	3	3	3	3	3	3	2	1	3	1	3	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO 1	3	3	3	3
CO 2	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code: BEE18OL2 /BEE20OL2	Subject Name:	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	PLC AND SCADA LAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1.Interfacing of lamp and button with PLC forON/OFFoperation.
2.Perform Delayed Operation Of Lamp By Using PushButton.
3.Multiple push button operation with delayed lamp forON/OFFoperation.
4.Combination of Counter & Timer for Lamp ON/OFFoperation
5.To study Set and Reset operation oflamp.
6..DOL Starter & Star Delta Starter operation by usingPLC.
7.PLC based temperature sensing usingRTD.
8.PLC based thermal ON/OFFcontrol.
9.PLC interfaced with SCADA and status read/ commandtransferoperation.
10.Parameter reading of PLC inSCADA.
11.Alarm annunciation usingSCADA.
12.Reporting and Trending in SCADASystem.
13.Temperature sensing usingSCADA
14.Pressure sensing usingSCADA

Total Hours: 45

Department of Computer Science and Engineering

Subject Code: BEE18OL3/ BEE20OL3	Subject Name: ELECTRICAL MAINTENANCE LAB	Ty / Lb/ ETL	L	T / S.L r	P/ R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE:

- To acquire knowledge on ElectricalWiring
- To know about energymeter
- To study about theInsulators
- To know about the Neutral andEarthing
- To learn about the DistributionTransformers

COURSE OUTCOMES (Cos): (3-5)

CO1	Capable of designing a Electrical wiring circuit for Residence.
CO2	Acquired knowledge o how to calibrate Energy meter
CO3	Knowledge on Insulators and its types
CO4	Ability to calculate the earthing of a particular area
CO5	Familiarity in Distribution Transformers

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	1	2	2	1
CO2	3	3	3	3	2	2	2	2	3	2	1	1
CO3	2	2	3	3	3	3	2	2	1	2	2	3
CO4	1	1	2	2	3	3	2	2	1	2	3	2
CO5	3	2	2	1	3	3	2	2	3	2	2	1

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	1	2	2			
CO2	3	1	2	3			
CO3	3	2	1	3			
CO4	1	2	3	1			
CO5	1	2	1	2			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Department of Computer Science and Engineering

Subject Code:	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
BEE18OL3/BEE20OL3	**ELECTRICAL MAINTENANCE LAB**	Lb	0	0/0	3/0	1

LABORATORY LIST OF EXPERIMENTS

1. Residential House Wiring Using switches, Fuse, Indicator, Lamp and EnergyMeter
2. Types ofWiring
3. Study Troubleshooting of ElectricalEquipment
4. To study earthing of electricalinstallation.
5. To study types ofinsulators.
6. To study maintenance schedule for distribution transformer, testing, maintenance and protection of distributiontransformer.
7. To study of measurement of insulation resistance andcapacitance.
8. To study of maintenance schedule for storagebatteryswitchgear and control equipment.
9. To study fault occurring in an induction motor to troubleshootthem.
10. To study the types of neutral earthing and substationearthing.
11. To study construction and types ofearthing.
12. Calibration of Energy meter

Total Hours: 45

Department of Computer Science and Engineering

Subject Code: BEE18OL4/ BEE20OL4	Subject Name: POWER ELECTRONICS LAB	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE:

- To obtain an overview of different types of power semiconductor devices and their switching characteristics with different triggeringmethods.
- To understand the operation , characteristics and performance parameters of controlled Rectifiers and Inverters.
- TounderstandthetechniquestocontrolthespeedofBrushlessDCMotorandSRMotor
- To understand the operation of AC VoltageControllers
- To understand the applications of Power Electronic devices and Electric drives in PowerSystem

COURSE OUTCOMES (Cos): (3-5)

CO1	Students will understand the operation of power electronics devices and gain knowledge of the comparative study of different devices based on their switching characteristics .
CO2	Students will understand the operation , characteristics and performance parameters of controlled Rectifiers and Inverters
CO3	Students capable to understand the techniques to control the speed of Brushless DC Motor and SR Motor
CO4	Students able to understand the operation of AC Voltage Controllers
CO5	Students able to understand the operation of different converters and incorporate in designing the HVDC transmission System

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	1	2	2	1
CO2	3	3	3	3	2	2	2	2	3	2	1	1
CO3	2	2	3	3	3	3	2	2	1	2	2	3
CO4	1	1	2	2	3	3	2	2	1	2	3	2
CO5	3	2	2	1	3	3	2	2	3	2	2	1

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	1	2	2			
CO2	3	1	2	3			
CO3	3	2	1	3			
CO4	1	2	3	1			
CO5	1	2	1	2			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Approval												

Subject Code:	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
BEE18OL4/ BEE20OL4	**POWER ELECTRONICS LAB**	Lb	0	0/0	3/0	1

LIST OF EXPERIMENT

1. SCR TriggeringCircuits.
2. Phase control usingTRIAC
3. Phase control usingSCR.
4. Characteristics ofSCR.
5. Characteristics ofIGBT.
6. Single phaseconverters.
7. Parallel Inverters.
8. Seriesinverters.
9. IGBT based PWM Inverters withfilters.
10. IGBT based PWM Inverters withoutfilters.
11. Step upChopper.
12. Step DownChoppers.

Total Hours : 45

Department of Computer Science and Engineering

Subject Code: BEE18OL5/ BEE20OL5	Subject Name: BIOMEDICAL INSTRUMENTATION LAB	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE:

- Study of BiologicalPreamplifiers.
- To learn Recording of ECG signal andAnalysis.
- To learn Recording ofAudiogram.
- To study Recording ofEMG
- To study the safety aspects of surgicaldiathermy

COURSE OUTCOMES (Cos): (3-5)

CO1	Understands Biological Preamplifiers.
CO2	Capable of Recording of ECG signal and Analysis.
CO3	Capable of Recording of Audiogram.
CO4	Capable of Recording of EMG
CO5	Understands Biological Preamplifiers.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	1	2	2	1	3	2	1
CO2	3	2	1	2	3	1	2	3	1	2	3	1
CO3	2	2	2	1	3	2	1	3	2	1	2	3
CO4	1	2	3	2	1	2	3	1	2	3	3	2
CO5	3	3	3	2	1	2	1	2	3	3	2	1

Cos / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	2	2	3	3			
CO2	3	3	3	2			
CO3	2	3	3	2			
CO4	3	3	2	3			
CO5	2	2	3	1			

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and SocialSciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						
Approval												

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering

B.Tech – Computer Science and Engineering (Internet of Things and Cyber Security Including Block Chain Technology)

(Full Time) - Regulation 2021

Subject Code: BEE18OL5/ BEE20OL5	Subject Name:	Ty /Lb/ ETL	L	T / S.Lr	P / R	C
	BIOMEDICAL INSTRUMENTATION LAB	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Study of BiologicalPreamplifiers.
2. Recording of ECG signal andAnalysis.
3. Recording ofAudiogram.
4. Recording of EMG,EEG
5. Recording of various physiological parameters using patient monitoring system and telemetry units.
6. Measurement of pH, pO2 andconductivity.
7. Study and analysis of functioning and safety aspects of surgicaldiathermy.
8. Acquisition of Heart sounds usingPCG
9. Biotelemetrysystem
10. BP measuringtechniques
11. Glucosesensor
12. Heart Lung machine

Total Hours : 45

Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095

Department of Computer Science and Engineering
OPEN ELECTIVES- BIOTECHNOLOGY

Subject Code: BBT18OE1/ BBT20OE1	Subject Name : FOOD AND NUTRITION	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

Department of Computer Science and Engineering

UNIT

Subject Code: BBT18OE1/ BBT20OE1	Subject Name : FOOD AND NUTRITION	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: Understanding relationship between food, nutrition and health

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Understand about the nutritional significance of carbohydrate
CO2	Understand the nutritive and caloric value of food
CO3	Know about the deficiency of vitamins , micro and macro nutrients

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	1	1	1	3
CO2	2	3	3	3	3	2	3	3	1	1	1	3
CO3	2	3	3	3	3	2	3	3	1	1	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	3				
CO2	3	3	3	3				
CO3	3	3	3	3				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

I: BASIC TERMS USED IN STUDY OF FOOD AND NUTRITION **9Hrs**

Understanding relationship between food, nutrition and health. Concept of Balanced Diet, Food Groups, Food Pyramid

UNIT-II:NUTRITIONAL SIGNIFICANCE OF CARBOHYDRATES **9Hrs**

Definition and classification of carbohydrates. Digestion and absorption of carbohydrates, Metabolism of carbohydrate (Glycolysis, glycogenesis and Glycogenolysis)

UNIT-III:NUTRITIONAL SIGNIFICANCE OF PROTEINS **9Hrs**

Definition for proteins, building blocks of proteins (Amino acid classification) functions of proteins, Metabolism of protein (Synthesis and degradation)

UNIT-IV:NUTRITIONAL SIGNIFICANCE OF LIPIDS **9Hrs**

Definition for lipids.Formation of lipids from fatty acids, Classification of lipids.Lipoproteins and their biological role Biochemical functions of lipids.

UNIT-V NUTRITIONAL SIGNIFICANCE OF VITAMINS AND MINERALS **9Hrs**

Classification, Biochemical function and deficiency diseases of Vitamins and minerals

Total Hours: 45

TEXT BOOK

1. Anita Tull (1996). Food and Nutrition.Third Edition.Oxford University Press.
2. Jenny Ridgwell (1996). Examining Food and Nutrition.Heinemann.
3. Paul Fieldhouse (1995). Food and Nutrition.Second Edition, Published by Chapman & Hall.

REFERENCE

1. Bamji MS, Krishnaswamy K, Brahmam GNV (2009). Textbook of Human Nutrition, 3rd Edition. Oxford and IBH Publishing Co. Pvt. Ltd.
2. Srilakshmi (2007). Food Science, 4th Edition. New Age International Ltd.
3. Srilakshmi,(2005), Dietetics, Revised 5th edition. New Age International Ltd.
4. Wardlaw MG, Paul M Insel Mosby (1996). Perspectives in Nutrition, Third Edition. Core Course ICMR.
5. Sumati R.Mudambi, M.V. Rajagopal (2001). Fundamentals of Foods and Nutrition. Fourth Edition.New Age International Publishers

Department of Computer Science and Engineering

Subject Code: BBT18OE2/ BBT20OE2	Subject Name : HUMAN PHYSIOLOGY	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :To learn about the various physiological mechanism involved in the human system

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Understand the basic respiratory mechanism , circulatory and digestive system
CO2	Understand the excretory system
CO3	Understand the Endocrine and Nervous system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	1	1	1	3
CO2	2	3	3	3	3	2	3	3	1	1	1	3
CO3	2	3	3	3	3	2	3	3	1	1	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			

Department of Computer Science and Engineering

						✓						

Subject Code: BBT18OE2/ BBT20OE2	Subject Name : HUMAN PHYSIOLOGY	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry	Ty	3	0/0	0/0	3

UNIT-I: RESPIRATORY SYSTEM **9Hrs**

Components of transport of Oxygen and Carbon dioxide, Role hemoglobin in transport. Mechanism of respiration, Chloride shift, Bhor's effect.

UNIT-II: CIRCULATORY SYSTEM: **9Hrs**

Introduction, function, types, of Circulatory organ. Design of Blood vessels, Blood Flow, blood pressure, Cardiac cycle

UNIT-III:DIGESTIVE SYSTEM **9Hrs**

Components of Digestive system, Digestion, absorption of carbohydrates, protein, lipids. Role of various enzymes involved in digestive process

UNIT-IV: EXCRETORY SYSTEM **9Hrs**

Structure and function of kidney, Structure of a nephron Mechanism of urine formation and other functions of kidney.

UNIT-V: ENDOCRINE AND NERVOUS SYSTEM **9Hrs**

Brief outline of various endocrine glands and their secretion, physiological role of hormones.Nervous system - Brain, spinal cord, nerve cells, and nerve fibers. Synapse, chemical and electrical synapses, nerve impulses, action potential and neurotransmission.

Total Hours: 45

TEXT BOOK

1. BJ Mejer, HS Meij, AC Meyer ,Human physiology, 2nd edition- AITBs publishers abd

distributers.

2. K. Saradha subramanyam, S, A Hand Book of Basic Human physiology. Chand & Co., Ltd.

3. Y. Rajakshmi, S , Guide to physiology. Chand & Co., Ltd.

REFERENCE

1. Gillian Pocock, Christopher D. Richards, David A. Richards. Third Edition 2006. Oxford University Press.
2. David Wright,(2000) Human Physiology and Health. Heinemann Educational Publishers.
3.Laurence A. Cole, Peter R. Kramer (2016) Human Physiology, Biochemistry and Basic Medicine Academic Press –Elsevier.
4.Indu Khurana,(2009) Textbook of Medical Physiology. Published by Elsevier.
5.Joseph Feher, (2017) Quantitative Human Physiology an Introduction. Second Edition, Academic Press- Elsevier

Subject Code: BBT18OE3/ BBT20OE3	Subject Name : CLINICAL BIOCHEMISTRY	Ty/ Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: To study the basic concept of clinical biochemistry and to gain knowledge about the inborn error of metabolism. To have knowledge on the clinical enzymology study

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Understand the disease related and inborn error in the metabolism
CO2	Understand the different organ test like liver test and gastric function test etc
CO3	Understand the Enzyme patterns in various function

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	1	1	1	3
CO2	2	3	3	3	3	2	3	3	1	1	1	3
CO3	2	3	3	3	3	2	3	3	1	1	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						
Approval												

Subject Code: BBT18OE3/ BBT20OE3	Subject Name CLINICAL BIOCHEMISTRY	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

UNIT-I: BASIC CONCEPTS OF CLINICAL BIOCHEMISTRY **9Hrs**

Specimen collection and processing (Blood, urine, faeces).Anti-coagulant and preservatives for blood and urine.Transport of specimens.

UNIT-II: DISEASES RELATED TO CARBOHYDRATE METABOLISM **9Hrs**

Regulation of blood sugar, Glycosuria - types of glycosuria. Oral glucose tolerance test in normal and diabetic condition. Diabetes mellitus and hyperglycemia hypoglycemia, Ketonuria and ketosis,Glucogen storage diseases

UNIT-III: DISEASES RELATED TO PROTEIN AND AMINOACID METABOLISM **9Hrs**

Diseases related to protein calorie malnutrition (Kwashiorkorand marasmus).Inborn errors of metabolism phenyl ketonuria, alkaptonuria and albinism

UNIT-IV: DISEASES RELATED TO LIPID METABOLISM **9Hrs**

Lipid and cholesterol, Classifications, mode of action. Factors affecting blood cholesterol level. Dyslipoproteinemias, IHD, atherosclerosis, and fatty liver.

UNIT-V: CLINICAL ENZYMOLOGY **9Hrs**

Enzymes a definition.Isoenzymes with examples.Role of marker enzymes in diseases. Enzyme patterns in acute pancreatitis, liver damage, bone disorder, myocardial infarction and muscle wasting.

Total Hours: 45

TEXTBOOK

1. H. Varley, A. H. Gowenlock, and M. Bell (2006) Practical Clinical Biochemistry (6th Ed) London: Heinemann Medical Books,New Delhi (India) : CBS
2.Ramakrishnan(2001) Clinical biochemistry(3rd Ed) Orient Longman private Ltd.
3.Text book of Medical Biochemistry - Dr. M.N. Chatterjee and Rane Shinde

REFRENCES

1.Clinical chemistry – William Hoffman
2. Clinical Biochemistry with clinical correlation – Devin, Wiley
3. Practical clinical biochemistry – Harold Varley, CBS, New Delhi
4. Nessar Ahmed (2017) Fundamentals of Biomedical Science, Second Edition, Oxford Press.
5. R.Swaminathan (2011) Handbook of Clinical Biochemistry,Second Edition,World Scientific Publishing Co.Pte.Ltd

Subject Code: BBT18OE4/ BBT20OE4	Subject Name : BIOPROCESS PRINCIPLES	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: To study the basic concept of Bioprocess concepts and to gain knowledge about the various industrial products produced by bioprocess technology.

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Understand the concept of biotranformtion reactions
CO2	Understand the requirements for the bioprocess reactions
CO3	Understand the industrial applications of bioprocess systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	3	3	3	2	1	2	3
CO2	2	3	3	3	3	3	3	3	2	1	2	3
CO3	2	3	3	3	3	3	3	3	2	1	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	3				
CO2	3	3	3	3				
CO3	3	3	3	3				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

Approval	B.TECH Regulation 2018

Subject Code: BBT18OE4/ BBT20OE4	Subject Name BIOPROCESS PRINCIPLES	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

UNITI: INTRODUCTION TO INDUSTRIAL BIOPROCESS **9 Hrs**

A brief survey of organisms, processes, products relating to modern biotechnology, General requirements of fermentation process

UNIT II: RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS **9 Hrs**

Medium requirements for fermentation processes, Media optimization, simple and complex media, design of various commercial media for industrial fermentation

UNIT III: DESIGN OF A FERMENTOR **9 Hrs**

Basic functions of a fermentor for microbial or animal cell culture, Bioreactors: Batch, fed batch reactor, continuous stirred tank reactors, residence time distribution.

UNIT IV: STERILIZATION KINETICS **9 Hrs**

Thermal death kinetics of microorganisms, batch and continuous heat sterilization, filter sterilization , air sterilization and design of sterilization equipment for batch and continuous.

UNIT V: APPLICATIONS **9 Hrs**

Production of Industrially important enzymes (Cellulase and Protease) and Antibiotics (Penicillin and Streptomycin)

Total Hours: 45

TEXT BOOKS

1. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books.

REFERENCES:

1. Bailey and Ollis, " Biochemical Engineering Fundamentals", McGraw Hill (2nd Ed.), 1986.
2. Shule and Kargi, " Bioprocess Engineering ", Prentice Hall, 1992.
3. Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Dekker, Inc.

Subject Code: BBT18OE5/ BBT20OE5	Subject Name : BIOSENSORS AND BIOMEDICAL DEVICES IN DIAGNOSTICS	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES : To study the biosensors based on DNA conformation changes, Biosensors based on protein conformation changes

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Understand the biosensors as functional analogs of chemo receptors
CO2	Gain knowledge on the types of biosenors and its application in the clinical field
CO3	Understand the basic principles involved in the non clinical biosensors in various field and other reagent less biosensors and array based chips

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	1	1	1	3
CO2	2	3	3	3	3	2	3	3	1	1	1	3
CO3	2	3	3	3	3	2	3	3	1	1	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

Subject Code: BBT18OE5/ BBT20OE5	Subject Name :BIOSENSORS AND BIOMEDICAL DEVICES IN DIAGNOSTICS	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	0/0	0/0	3

UNITI: FUNDAMENTALS OF BIOSENSORS **9Hrs**

Biosensors as Functional Analogs of Chemo receptors- Immobilization and biosensor construction, Biosensor instrumentation-Transduction principles used in a biosensor, Biocomponent of the sensor. Biological sensing elements and transducer systems- their sensitivity specificity and linearity.

UNIT II: TYPES OF BIOSENSORS **9Hrs**

Thermometric Indication with Thermistors, Opto electronic Sensors, Piezoelectric Sensors, Electrochemical Sensors, Potentiometric Electrodes, Amperometric Electrodes, Conductometric Measurement. Flow injection analysis based biosensors, fiber optics biosensors,Bioluminescence biosensors, Microbial biosensors, Affinity biosensors, immunosensors.DNA Probes, organic acid probes, antigen-antibodies reaction, biochemical detection of organelles, receptors, sensors for pollution gases stability and reusability of sensors.

UNIT III: BIOSENSORS FOR CLINICAL ANALYSIS **9Hrs**

Biosensors for personal diabetes management (Glucose, Galactose, Gluconate, Lactate, Pyruvate Sensors) Noninvasive Biosensors in Clinical analysis and health care.

UNIT IV: NON CLINICAL APPLICATION OF BIOSENSORS **9 Hrs**

Applications in Veterinary, Agriculture, Food production, Environmental control and pollution monitoring, and bioprocess industry.

UNIT V: REAGENTLESS BIOSENSORS & ARRAY-BASED CHIPS **9Hrs**

Surface Dielectric Enhancement, Gold nanoparticle enhanced surface plasmon resonance, carbon nanotube and silicon nanowire enhanced conductivity, catalytic activation, electro catalytic detection, catalytically enabled optical and magnetic detection, Reagent less Immunoelectrodes, biomolecule conformational modulated effects, Biosensors based on DNA conformation changes, Biosensors based on protein conformation changes

Total Hours: 45

TEXT BOOK

1.Turner A.P.F, Karube I and Wilson G.S, (1987) Biosensors- Fundamentals and applications, Oxford Univ.Press.
2.Yang V.C. and T.T.Ngo,(2000) Biosensors and their Applications, Academic/Plenum Publishers.
3.Ashok Mulchandani and Kim R Rogers,(1998)Enzyme and Microbial bio sensors: Techniques and Protocols,Humana Press Totowa, NJ.

REFERENCE BOOKS

1. Turner A.P.F and Wilsons G.S, (1997) Biosensors: Fundamentals and Applications, Oxford Science Publications
2. Zoraida P.Aguilar (2013),Nanomaterials for Medical Applications,Elsevier
3. Roger J Narayan (2017), Medical Biosensors for Point of care (POC) applications, Wood Publishing –Elsevier.
4.Ashutosh Tiwari, Murugan Ramalingam,Hisatoshi Kobayashi, Anthony P.F Turner (2013), Biomedical Materials and Diagnostic Devices

Subject Code:	Subject Name : Basic Bioinformatics	Ty / Lb/	L	T /	P/	C

Subject Code: BBT18OE6 /BBT20OE6	Subject Name :Basic Bioinformatics	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: To learn nucleotide, protein and genome databases and know about the file formats . To understand pairwise and multiple sequence alignment and the principle and to gain knowledge on approaches for gene prediction methods in prokaryotes and eukaryotes

COURSE OUTCOMES (COs) : Upon completion of this course, students will be able to

CO1	Develop bioinformatics tools with programming skills.
CO2	Apply computational based solutions for biological perspectives.
CO3	Pursue higher education in this field.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	2	2	2	3
CO2	2	3	3	3	3	2	3	3	2	2	2	3
CO3	2	3	3	3	3	2	3	3	2	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	3				
CO2	3	3	3	3				
CO3	3	3	3	3				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

BBT18OE6/ BBT20OE6		**ETL**		**S.Lr**	**R**	
	Prerequisite: NIL	Ty	3	0/0	0/0	3

UNIT I:BIOLOGICAL DATABASES AND DATA RETRIEVAL 9 Hrs

Nucleotide databases (Genbank, EMBL), Sequence submission Methods and tools (Sequin, Sakura), Sequence retrieval systems (Entrez), Protein (Swiss-Prot, Tr-EMBL, Expasy), Genome (NCBI, EBI, TIGR), Metabolic Pathway DB (KEGG)

UNIT II: PAIRWISE SEQUENCE ALIGNMENT 9 Hrs

Similarity, Identity and Homology, Global Alignment, Local Alignment, Database Search methods & tools, Scoring Matrices,

UNIT III: MULTIPLE SEQUENCE ALIGNMENT 9 Hrs

Significance of MSA, Scoring of MSA, PSI/PHI-BLAST.

UNIT IV: GENE PREDICTION 9 Hrs

Structure in Prokaryotes and Eukaryotes, Gene prediction methods, Neural Networks, Pattern Discrimination methods, Signal sites Predictions (Promoter, Splice, UTR, CpG-islands) Methods of Construction of Phylogenetic trees

UNIT V:NUTRIGENOMICS9 Hrs

Introduction to Nutrigenomics and Nutraceuticals

Total Hours: 45

REFERENCES

1. Introduction to Bioinformatics - A. Lesk 2002, Oxford University Press
2. Fundamental concepts of Bioinformatics by D.E. Krane and M.L Raymer, Pearson Education 2003 ISBN 81-297-0044-1
3. Current Protocols in Bioinformatics, Edited by A.D. Baxevanis et. al., Wiley Publishers 2005
4. Introduction to Computational Molecular Biology by Joao Carlos Setubal, Joao

OPEN LAB

Subject Code: BBT18OL1/ BBT20OL1	Subject Name : Basic Biochemistry Lab	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Laboratory Safety and Hygiene
2. Preparation of Molar solution
3. Preparation of percentage solution
4. Preparation of Normal solution
5. Qualitative analysis of carbohydrates (any one sample)
6. Qualitative analysis of Proteins (any one sample)
7. Isolation of Casein
8. Isolation of starch

TEXT BOOKS:

1. Gupta R.C. and Bhargavan S. Practical Biochemistry.
2. David T. Phummer. Introduction of Practical Biochemistry (II Edition).

Subject Code: BBT18OL2/ BBT20OL2	Subject Name : Basic Bioprocess lab	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Lb	0	0/0	3/0	1
L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab						
OBJECTIVE :.To learn the basic knowledge about different types of biotransformation reactions for the production of commercially important products						

COURSE OUTCOMES (COs) : After finishing this course the students would be able to												
CO1	Acquire knowledge about the basics Bioprocess reactions											
CO2	Know about the culturing techniques											
Mapping of Course Outcomes with Program Outcomes (POs)												
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	3	3	3	2	3	3	3	2	1	3
CO2	2	3	3	3	3	2	3	3	3	2	1	3
COs / PSOs	**PSO1**		**PSO2**		**PSO3**		**PSO4**					
CO1	3		3		3		3					
CO2	3		3		3		3					
3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low												

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	open lab		
										✓		

Subject Code: BBT18OL2/ BBT20OL2	Subject Name : Basic Bioprocess lab	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Pure culture techniques
2. Determination of growth curve of the given organism
3. Screening of amylase producing microorganism
4. Screening of protease producing microorganism
5. Determination of TDP (Thermal death point)
6. Determination of TDT (Thermal death time)
7. Production of ethanol using batch fermentation

Reference

1. Manual of industrial microbiology and Biotechnology, Demain A.L. Solomon, J.J., 1986. ASM press.
2. Industrial Microbiology, Reed C., Prescott and Dann's, 1982. Macmillan publishers.

Subject Code: BBT18OL3/ BBT20OL3	Subject Name : Basic Microbiology Lab	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :.To learn the basic knowledge about different types of Microorganisms identification by staining methods

COURSE OUTCOMES (COs) : After finishing this course the students would be able to

O1	Acquire knowledge about the basics of microbiology
CO2	Know about the staining methods
CO3	Understand the staining methods and identification

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	3	3	2	3	3	3	2	1	3
CO2	2	3	3	3	3	2	3	3	3	2	1	3
CO3	2	3	3	3	3	2	3	3	3	2	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	3	3	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	open lab		
										✓		

8.

Subject Code: BBT18OL3/ BBT20OL3	Subject Name : Basic Microbiology Lab	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Sterilization technique – Moist heat, dry heat
2. Preparation of culture media (a) Solid medium (b) liquid medium
3. Sterilization of media
4. Pure culture technique
5. Use of microscope
6. Identification of microbes - simple Staining
7. Identification of microbes – Gram staining
8. Hanging drop preparation for motility test

TEXT BOOKS

1. Monica Chessbrough(1999) Laboratory Manual in Microbiology(Vol I & II)Cambridge University Press
2. collee, J.G. etal., "Mackie & McCartney Practical Medical Microbiology" 4th Edition, Churchill Livingstone, 1996.

REFERENCE BOOKS

1. Cappucino (1999) Microbiology - A laboratory Manual Benjamin Cumming

Subject Code: BBT18OL4/ BBT20OL4	Subject Name : Basic Bioinformatics Lab	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Molecular Biology & Protein Science	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL :Theory/Lab/Embedded Theory and Lab

OBJECTIVE : To enable the students to understand To understand basic commands in UNIX OS.To understand different biological databases.To carry out sequence and phylogenetic analysis.

COURSE OUTCOMES (COs) : After completing this course students were able

CO1	To demonstrate the protein/DNA sequence search methods and sequence alignment databases. To

	understand and hands-on-training on the genome sequence analysis and annotation.
CO2	To analyze the comparative genomics.
CO3	To use various computational tools for expression analysis to identify open reading frames, mutations, conserved region

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	3	3	3	2	3	3	2	2	2	3
CO2	2	3	3	3	3	2	3	3	2	2	2	3
CO3	2	3	3	3	3	2	3	3	2	2	2	3

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**				
CO1	3	3	3	3				
CO2	3	3	3	3				
CO3	3	3	3	3				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Open lab		
										✓		

Subject Code:	Subject Name :Basic Bioinformatics Lab	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
BBT18OL4/ BBT20OL4	Prerequisite: Molecular Biology & Protein Science	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Demonstration of Entrez
2. Demonstration of SRS
3. Exploring nucleotide database Gen Bank
4. Exploring Protein Database Uniprot
5. Database Searches with BLASTP
6. Pair wise Sequence Alignment -EMBOSS
7. Multiple sequence alignment – CLUSTAL OMEGA

REFERENCE BOOK

1. Bioinformatics and Functional Genomics by Jonathan Pevsner
2. Bioinformatics Data Skills: Reproducible and Robust Research with Open by Vince Buffalo
3. Introduction to Bioinformatics Using Action Labs by Jean-Louis Ryan Rossi, Stephen Sheel

OPEN ELECTIVES- MECHANICAL ENGINEERING

Subject Code: BME18OE1/BME 20OE1	Subject Name : INDUSTRIAL ENGINEERING	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial S.Lr : Supervised Learning P : Project R : Research C:Credits

T/L/ETL : Theory/Lab./Embedded Theory and Lab.

OBJECTIVE: Students will learn:

- Various techniques of workmeasurement
- Details of plant layout and material handlingdevices
- Basic concepts ofERP.

COURSE OUTCOMES (COs) :

CO1	Various techniques of Work Measurement
CO2	Details of Plant Layout and Material Handling devices
CO3	Human factor design
CO4	Understand wages and incentives
CO5	Basic concepts of ERP

Mapping of Course Outcomes(COs) with Program Outcomes (Pos) & Program Specific Outcomes (PSOs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		2		1			2	1		1
CO2	1	1	2	2		2	1		1	2	1	1
CO3	1	1				2	1		1	2	1	2
CO4	1	1				2		2				1
CO5	1	1			3	2			1	2		1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1			1	1
CO2		1	2	1
CO3		1	2	1
CO4				1
CO5			2	1

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social	Program Core	Program Electives	Open Electives	Practical / Project	Internships /Technical	Soft Skills			
						✓						

Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	**3**	

Subject Code: BME18OE1/BME20OE1	Subject Name : INDUSTRIAL ENGINEERING	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

UNIT- I: WORK STUDY & WORK MEASUREMENT **9 Hrs**

Work study – Techniques – Productivity, Improving productivity by reducing work content- Human factors in work study.Method study – Basic procedure – Recording techniques - Micro–motion study, Threbligs, SIMO chart, Principles of motion economy.Work Measurement – Techniques – Time study – Allowances – Work sampling – PMTS – MTM.

UNIT- II: SITE SELECTION, PLANT LAYOUT & MATERIAL HANDLING **9Hrs**

Site Selection: Importance of plant location – choice of site for location –State regulations on location – Industrial Estates. Plant layout: Types of factory buildings, OBJECTIVES of good plant layout, Principles, Techniques used, Types, Flow pattern, Line Balance, computerized plant layout. Material Handling: Functions, OBJECTIVES, principles, Devices used, Relation between plant layout and material handling.

UNIT- III: ERGONOMICS **9Hrs**

Techniques – Analysis – Equipment Design – Fatigue – Motivation theory of Fatigue – Fatigue tests- Duties of a human factor Engineer – Human effectiveness improvement through ergonomics.

UNIT- IV: WAGES & INCENTIVES **9Hrs**

Wages: Wage & salary policies, systems of wage payments, Principles of wage administration, National Wage Policy, Fair wage committee report, Need based minimum wage Incentives: Need, Incentive plans, Comparison of various Incentive plans, Administration of wage incentives.

UNIT- V: ENTERPRISE RESOURCE PLANNING (ERP) **9Hrs**

Need for optimal use of Resources, MRP I & II, Supply chain Management, Evolution of ERP, BPR, Lean Manufacturing, Popular ERP Packages, Implementation of ERP, Benefits of ERP.

Total Hour: 45

TEXT BOOKS

1)O.P. Khanna, (2005) “Industrial Engineering and Management”, Khanna Publishers.
2)K.KAhuja, “Industrial Management”, Khanna Publishers.
3)Martand Telsang, “Industrial Engineering and Production Management”.

REFERENCES

1) M.Mahajan, “Industrial Engineering and Production Management”, Dhanpat Rai &CO.,
2) B. Kumar, (2005) “Industrial Engineering”, Khanna Publishers.
3) International Labour Organization (ILO), (2004) “Introduction to Work study”, Universal Publishing Corporation.
4) H. B. Maynard, “Industrial Engineering, Handbook”, McGraw Hill Book Company, International Edition.
5) Marvin E. Mandel, “Time & Motion study”, Prentice Hall, Private Limited, International Edition.
6) James M Apple, “Principles of Layout & Materials Handling”, Ronalds Press, International Edition.
7) V. K. Garg & N.K. Venkatakrishnan, (2004) “Enterprise Resource Planning, Concepts & Practice”, Prentice Hall of India Private Limited.

Subject Code:	Subject Name : FINITE ELEMENT METHOD	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
BME18OE2/ BME20OE2	**Prerequisite: Nil**	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE: The student will learn

- Fundamentals of finite element analysis and theirapplications.
- Method of solving one, two and iso-parametricelements.

COURSE OUTCOMES (COs) :

CO1	To Impart Knowledge about Introduction to Finite Element Analysis
CO2	To impart knowledge about one-dimensional problems
CO3	To impart knowledge about two dimensional scalar variable problems
CO4	To impart knowledge about two dimensional vector variable problems
CO5	To impart knowledge about isoparametric formulation and advanced topics

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	2	3	3	3	3	2	1	1	1	2	1	2
CO2	2	3	3	3	3	2	1	1	1	2	1	2
CO3	2	3	3	3	3	2	1	1	1	2	1	2
CO4	2	3	3	3	3	2	1	1	1	2	1	2
CO5	2	3	3	3	3	2	1	1	1	2	1	2

Cos / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	2	3	3	2				
CO2	2	3	3	2				
CO3	2	3	3	2				
CO4	2	3	3	2				
CO5	2	3	3	2				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

Subject Code: BME18OE2 /BME20OE2	Subject Name : FINITE ELEMENT METHOD	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	0/0	0/0	3

UNIT- I INTRODUCTION **9 Hrs**

Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT- II ONE-DIMENSIONAL PROBLEMS **9 Hrs**

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors-Assembly of Matrices - Solution of problems from solid mechanics including thermal stresses-heat transfer.

UNIT- III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS **9Hrs**

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements and Quadrilateral elements- Shape functions and element matrices and vectors.Torsion of Non circular shafts.

UNIT- IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS **9Hrs**

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Constitutive matrices and Strain displacement matrices – Stiffness matrix – Stress calculations - Plate and shell elements.

UNIT- V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS **9Hrs**

Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements –

– Numerical integration - Matrix solution techniques – Solutions Techniques to Dynamic problems –

Introduction to Analysis Software- Introduction to Non Linearity. **Total Hours: 45**

TEXT BOOKS:

1.J.N.Reddy, “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGrawHill,2005

2.Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., NewDelhi, 2007.

REFERENCES:

1.Logan, D.L., “A first Subject in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002.

2.Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.

3.Rao, S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butter worth Heinemann,

2004.

4.Chandrupatla and Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition,

Subject Code: BME18OE3/ BME20OE3	SubjectName: AUTOMOBILEENGINEERING	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory andLab

OBJECTIVE: The student will learn

- Various automobile parts, power transmission from engine to various parts of the automobile, engine cooling, lubrication and also about various pollutants and itscontrol.

.

COURSE OUTCOMES (COs) : (3- 5)

CO1	I.C engine parts and different chassis
CO2	Engine cooling, lubrication and ignition system
CO3	Working of transmission system like gear box, propeller shaft and differential.
CO4	Knowledge on Steering, suspension system.
CO5	Knowledge on working of braking system and Hybrid Vehicles and Fuel cells

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		2		1		3					
CO2		1		2								
CO3	3						2					
CO4	3		2		1		3					
CO5	3		2		1		3					

Cos / PSOs	PSO1	PSO2	PSO3	PSO4								
CO1	3		2									
CO2	2		2									
CO3	2	2	1									
CO4	2	2	1									
CO5	2	2	1	2								

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

Subject Code:	SubjectName: AUTOMOBILE ENGINEERING	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
BME18OE3/ BME20OE3	**Prerequisite: Nil**	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT- I: VEHICLE STRUCTURE AND ENGINES **9Hrs**

Vehicle Chassis –types- layout- body-integral and chassis mounted body- vehicle specifications- power and torque requirements- choice of engine for different applications. Engine types and construction –-Cylinder- cylinder head-Crank case-Piston- connecting rod – crank shaft-valves- liners-manifolds.

UNIT- II: ENGINE AUXILIARY SYSTEMS AND POLLUTION CONTROL **9Hrs**

Fuel supply system to SI and CI engines–Electronic.Lubrication system-cooling system-ignition system-spark timing-firing order, electronic fuel injection system-types. Pollution from engines and their control- Exhaust gas recirculation - Catalytic converters, Indian emission standards**.**

UNIT- III: TRANSMISSION SYSTEMS **9Hrs**

Clutches –single& multi plate –diaphragm-fluid coupling-torque converter Gear boxes-manual-sliding mesh-constant mesh-synchro mesh- automatic transmission. Universal joints-propeller shaft-Hotchkiss drive-torque tube drive. Differential-types- construction. Four wheel drive.

UNIT- IV: STEERING AND SUSPENSION SYSTEMS **9Hrs**

Principle of steering-steering geometry and wheel alignment-steering linkages-steering gear boxes-power steering. Wheel and tyre construction-type and specification-tyre wear and causes-front axles arrangements. Suspension system-need and types-independent systems-coil-leaf spring-torsion bar-shock absorbers-air suspension.

UNIT- V: BRAKE SYSTEMS **9Hrs**

Auto Electrical Components and Alternative Power Plants. Brake –need –types-mechanical-hydraulic- pneumatic-power brake-trouble shooting of brakes. Principles of modern electrical systems-battery-dynamo- starting motor-lighting- automobile conditioning.Electric hybrid vehicle and fuel cells.

Total Hours: 45

TEXT BOOKS

1) K.K.Ramalingam, (2007) “Automobile Engineering”, SciTechPublications.
2) Kirpal Singh, (2012) “Automobile Engineering Vol-I&II”.
3) R.B.Gupta, (2013) “Automobile Engineering”, Satya PrakashanPublishing

REFERENCES

1) Joseph Heitner, “Automotive Mechanics”, Affiliated East West PressLtd.
2) “Newton and Steeds, Motor Vehicles”, ELBS –13EDITION.
3) William Crouse, (2007) “Automotive Mechanics”, Tata McGrawHill.

Subject Code:	Subject Name : INDUSTRIAL ROBOTICS	Ty / Lb/ ETL	L	T / S.L r	P/ R	C
BME18OE4/ BME20OE4	**Prerequisite: Nil**	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE: **OBJECTIVES:** Students will learn

- Basic components of an industrial robot and Sensors used inrobots
- Robot programming methods and Robotapplications

COURSE OUTCOMES (COs) : (3- 5)

CO1	Knowledge of basic concepts of a robot.
CO2	Knowledge of different components and operation with respect to robot design.
CO3	Knowledge of aware of sensing and machine vision concepts and its applications.
CO4	Knowledge of writing programme for robot.
CO5	Knowledge of able to design robot cell and its applications.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	1	1	3	2	1	3
CO2	3	3	3	3	3	1	1	1	3	2	1	3
CO3	3	3	3	3	3	1	1	1	3	2	1	3
CO4	3	3	3	3	3	1	1	1	3	2	1	3
CO5	3	3	3	3	3	1	1	1	3	2	1	3

Cos / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	3
CO2	1	1	1	3
CO3	1	1	1	3
CO4	1	1	1	3
CO5	1	1	1	3

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

Subject Code: BME18OE4/ BME20OE4	Subject Name : INDUSTRIAL ROBOTICS	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT- I: INTRODUCTION **9 Hrs**

Definition of a Robot – Basic Concepts –- Robot components –manipulator-configurations – joints-degree of freedom. Types of Robot Drives – Basic Robot Motion types – Point to Point Control – Continuous Path Control.

UNIT- II:COMPONENTSANDOPERATIONS **9 Hrs**

Basic Control System Concepts – open loop and closed loop control-Control System Analysis – Robot Actuation and Feed Back, Manipulators – Direct and Inverse Kinematics, Co- ordinate Transformation – Brief Robot Dynamics, Types of Robot and Effectors – Grippers – Tools as End Effectors – Robot / End Effort Interface.

UNIT- III: SENSING ANDMACHINEVISION **9Hrs**

Range Sensing – Proximity Sensing – Touch sensing – Force and Torque Sensing. Introduction to Machine Vision – functions and applications.

UNIT-IV:ROBOTPROGRAMMING9Hrs

Methods – Languages –programming for pick and place applications-palletizing. Capabilities and Limitation – Artificial Intelligence – Knowledge Representation – Search Techniques – AI and Robotics.

UNIT- V:ROBOT CELL DESIGNANDAPPLICATIONS **9Hrs**

Robot cell design-types and control. Applications of Robots –process Applications in welding and painting – Assembly applications– Material Handling applications.

Total Hours: 45

TEXT BOOK

1) K. S. Fu, R. C. Gonalez, C.S.G. Lee, “Robotics Control Sensing Vision and Intelligence”, McGraw Hill International Edition,10987.

REFERENCES

1) Mikell P. Groover, Mitchell Weiss, (2008) “Industrial Robotics, Technology, Programming and Application”, Tata McGraw Hill International Editions,10986.
2) Richard D. Klafter, Thomas A. Chonieleswski and Michael Negin, (1989) “Robotic Engineering – An Integrated Approach”, Prentice Hall Inc., Englewoods Cliffs, NJ, USA,109809.

Subject Code:	SubjectName: RENEWABLE SOURCES OF ENERGY	Ty / Lb/ ETL	L	T / S.L r	P/R	C
BME18OE5/ BME20OE5	**Prerequisite: Nil**	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial S Lr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: Students will learn

- The concept, principles and characteristics of different renewable energysystems.
- Energy conversiontechniques

COURSE OUTCOMES (COs) : (3- 5)

CO1	Knowledge on principles of solar energy and its measurement.
CO2	Knowledge on Solar energy applications in various fields.
CO3	Knowledge on Biomass and bioenergy conversions and wind energy.
CO4	Knowledge on, Ocean Thermal energy, Geothermal energy
CO5	Knowledge on Direct energy conversions like Thermo electric generator, MHD and Fuel cells

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2		3	3									
CO3			2									
CO4			2	2		2	3			2	2	2
CO5			2	2		2	3			3	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2		
CO2	3	3	2	
CO3	3	2		
CO4	3	2	2	
CO5	3	2	2	2

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Tech	Soft Skills			
						✓						

Subject Code: BME18OE5/ BME20OE5	SubjectName: RENEWABLE SOURCESOF ENERGY	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT- I PRINCIPLES OFSOLARRADIATION **9Hrs**

Role and Potential of new and renewable source, the solar energy option, Environmental impact of solar power,Solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, Instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT- IISOLARENERGY **9Hrs**

SOLAR ENERGY COLLECTION**:** Flat plate and concentrating collectors- classification- orientation and thermal analysis-advanced collectors.

SOLAR ENERGY STORAGE:

Different methods, sensible, latent heat and stratified storage, solar ponds.Solar applications-solarheating/coolingtechniques,solardistillationanddrying,photovoltaicenergyconversion.

UNIT- III WIND ENERGYANDBIOMASS **9Hrs**

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, erformance characteristics. BIOMASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-Gas digestors, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation, economic aspects.

UNIT- IV GEOTHERMAL, TIDAL ANDWAVEENERGY **9Hrs**

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing OTEC: Principles, utilization, setting of OTEC plants, thermodynamic cycles.

TIDAL AND WAVE ENERGY: Potential and conversion techniques, mini hydel power plants, and their economics**.**

UNIT- V: DIRECTENERGYCONVERSION **9Hrs**

Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, MHD Power generators, principles, working, Fuel cells: principle, working -types - Selection of fuels and operating conditions. **Total Hours: 45**

TEXT BOOKS

1) G.D.Rai, (2004) “Non-Conventional Energy Sources” KhannaPublishers.
2) Ashok V Desai, (2003) “Non-Conventional Energy”, Wiley Eastern.
3) K.M.Mittal, (2007) “Non-Conventional Energy Systems”, WheelerPublishing.
4) Ramesh & Kumar, (2007) “Renewable Energy Technologies”, Narosa PublishingHouse.

REFERENCES

1) Twidell & Weir, (2006) “Energy Sources”, Taylor &Francis
2) Sukhame, (2009) “SolarEnergy”.

Subject Code: BME18OE6/ BME20OE6	Subject Name : REFRIGERATION AND AIR CONDITIONING	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: Students will learn

- The working principle of refrigerators and air conditioningsystems.
- Different cycles used inrefrigeration.
- Alternate refrigerants to reduce global warming **.**

COURSE OUTCOMES (COs) : (3- 5)

CO1	Knowledge on different type of refrigeration systems and properties of refrigerants.
CO2	Knowledge on different types of controlling and balancing of refrigerating system components
CO3	Knowledge on Pressure and temperature controlling and system balancing
CO4	Knowledge on Psychometric properties and A/C systems
CO5	Knowledge of Applications of cryogenic engineering in various Mechanical engineering fields

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2		2	3	2		1		
CO2	3	2	2	2		2	3	2		1		
CO3	3	2	2	2		2	3	2		1		
CO4	3	2	2	2		2	3	2		1		
CO5	3	2	2	2		2	3	2		1		

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**				
CO1	3	2	2					
CO2	3	2	2					
CO3	3	2	2					
CO4	3	2	2					
CO5	3	2	2					

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technic	Soft Skills			
						✓						

Subject Code: BME18OE6/ BME20OE6	Subject Name : REFRIGERATION AND AIR CONDITIONING	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT- I: REFRIGERATION CYCLES AND REFRIGERANTS 9 Hrs

Vapour Compression Réfrigération Cycle-Simple Saturated Vapour Compression Refrigeration Cycle. Thermodynamic Analysis of the above.Refrigerant Classification, Designation, Alternate Refrigerants, Global Warming Potential & Ozone Depleting Potential Aspects.

UNIT- II: SYSTEM COMPONENTS 9 Hrs

Refrigerant Compressors – Reciprocating Open & Hermetic Type, Screw Compressors and Scroll Compressors – Construction and Operation Characteristics.Evaporators – DX Coil, Flooded Type Chillers Expansion Devices - Automatic Expansion Valves, Capillary Tube & Thermostatic Expansion Valves. Condensing UNIT-s and Cooling Towers.

UNIT- III: CYCLING CONTROLS AND SYSTEM BALANCING 9 Hrs

Pressure and Temperature Controls.Range and Differential Settings.Selection and Balancing of System Components-Graphical Method.

UNIT- IV: PSYCHROMETRY & AIR CONDITIONING 9 Hrs

Moist Air Behavior, Psychrometric Chart, Different Psychrometric Process Analysis. Summer and Winter Air-conditioning, Cooling Load Calculations, Air Distribution Patterns, Dynamic and Frictional Losses in Air Ducts, Equal Friction Method, Fan Characteristics in Duct Systems.

UNIT- V: INTRODUCTION TO CRYOGENIC ENGINEERING 9 Hrs

Introduction to cryogenic engineering-applications of cryogenics in various fields-low temperature properties of materials- mechanical, thermal, electrical and magnetic properties- properties of cryogenic fluids-cryogenic fluid storage and transfer systems- cryogenic insulation.

Total Hours: 45

TEXT BOOKS

1) W.F.Stocker and J.W.Jones, (2009) “Refrigeration & Air Conditioning”, McGraw Hill Book.

Company.

2) Randall F.Barron, (1985) “Cryogenic systems”, Oxford University press.

REFERENCES

1) R.J.Dossat, (2005) “Principles of Refrigeration”, John Wiley and Sons Inc., 6th edition.

2) Manohar Prasad, (2009) “Refrigeration and Air Conditioning”, Wiley Eastern Ltd.

Subject Code: BME18OE7/ BME20OE6	Subject Name : COMPOSITE MATERIALS	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: Students will learn

- Different composites and their manufacturingmethods
- Design parameters of composites
- To gain knowledge in need and applications of compositematerials

.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Aware of different composites and their manufacturing methods
CO2	Know the mechanics and performance of composite materials
CO3	Understand the design parameters of composites
CO4	Knowledge on moulding pultrusion ,filament winding
CO5	Knowledge of Applications of statics mechanical in various Mechanical engineering fields

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		3			3		3			2
CO2	2	2	2	3					3			2
CO3	2	2	2	3			3	3	3			2
CO4												
CO5						1						

Cos / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2
CO2		3	3	3
CO3	1	3	3	
CO4				
CO5				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

Subject Code:	Subject Name : COMPOSITE MATERIALS	Ty / Lb/ ETL	L	T / S.L r	P / R	C
BME18OE7/ BME20OE6	**Prerequisite: Nil**	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT-I:INTRODUCTION9Hrs **9 Hrs**

Limitations of Conventional Materials- Definition of Composite Materials- Types and Characteristics Applications.

UNIT-II:MATERIALS9Hrs

Fibers- Materials- Fiber Reinforced Plastics- Thermo set Polymers- Coupling Agents, Fillers and Additives- Metal Matrix and Ceramics Composites.

UNIT-III:MANUFACTURING **9Hrs**

Fundamentals- bag moulding- compression moulding pultrusion- filament winding- other manufacturing process-quality inspection and non-destructive testing.

UNIT- IV: MECHANICSANDPERFORMANCE **9Hrs**

Introduction to Micro-mechanics- Unidirectional Lamina-Laminates- Inter laminar Stress- Statics Mechanical Properties- Fatigue Properties- Impact Properties- Environmental Effects- Fracture Mechanics and Toughening mechanisms, Failure Modes

UNIT-V:DESIGN **9Hrs**

Failure Predictions- Design Considerations- Joint Design- Codes- Design Examples.Optimization of Laminated Composites- Application of FEM for Design.

Total Hours: 45

TEXT BOOKS

1) P.K.Mallick, (2006) "Fiber-Reinforced Composites", Monal Deklatr Inc., NewYork.
2) B.D.Agrawal and L.J.Broutmam, (2006) "Analysis and Performance of Fiber Composites", John Wileyand Sons, New York.

REFERENCES

1) Micael hyer, (1998) "Stress Analysis of Fiber- Reinforced Composite Materials", Tata McGrawHill.
2) Ronald Gibson, (2007) "Principles of Composite Material Mechanics", Tata McGrawHill.

OPEN ELECTIVE

LABS

Subject Code: BME18OL1/BME20OL1	**SubjectName:** **INTERNALCOMBUSTIONENGINES & STEAMLAB**	**Ty / Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil	**Lb**	**0**	**0/0**	**3/0**	**1**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: The student will learn

- To evaluate the performance of steam turbines and ICengines.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Knowledge on performance of steam turbines
CO2	Knowledge on performance and heat balance test of diesel engines
CO3	Knowledge on performance test of Petrol engines
CO4	Knowledge on multi cylinder engine performance and Morse test
CO5	Knowledge on performance test of diesel engines with different fuels

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**P O9**	**PO10**	**PO11**	**PO 12**
CO1	3	2		2	1		2					
CO2	3	1		2			2					
CO3	2			3			3					
CO4	3	1		2			2					
CO5	2			3			3					

Cos / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**				
CO1	3	2						
CO2	2	2						
CO3	2	2						
CO4	2	2						
CO5	2	2						

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Open Elective Lab/ Practical		
						✓						

Subject Code: BME18OL1/ BME20OL1	SubjectName: INTERNALCOMBUSTION ENGINES & STEAMLAB	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Lb**	**0**	**0/0**	**3/0**	**1**

LIST OF EXPERIMENTS:

1. Study of IC engines components and loadingdevices.
2. Valve timing and port timing diagrams of 2stroke and 4stroke petrol and dieselengines
3. Performance test on single cylinder 4-stroke petrolengine.
4. Performance test on single cylinder 4-stroke dieselengine.
5. Heat balance test on 4-stroke single cylinder dieselengine.
6. Study of steam generators andturbines.
7. Performance and energy balance test on a steamgenerator.
8. Performance and energy balance test on a steamturbine.
9. Performance test on a steamcondenser

Total Hours: 45

Subject Code: BME18OL2/ BME20OL2	Subject Name : COMPUTER AIDED DESIGN AND ANALYSIS LAB	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Lb**	**0**	**0/0**	**3/0**	**1**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To get practical knowledge of modeling of various machine parts using Auto CAD and other modelingsoftware.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the benefits of computer aided design
CO2	Understand the method of dimensioning and symbols
CO3	Able to draw the machine parts in CATIA Software.
CO4	Understand the knowledge on design packages (Solid works and CATIA Software's)
CO5	To analyze the material properties and deflections (Ansys)

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3		2	2	3	3	2
CO2	3	3	3	3	3	H		2	2	3	3	2
CO3	3	3	3	3	3	3		2	2	3	3	2
CO4	3	3	3	3	3	3		2	2	3	3	2
CO5	3	3	3	3	3	H		2	2	3	3	2

Cos / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Open Elective Lab/ Practical		
										✓		

Subject Code: BME18OL2/ BME20OL2	Subject Name : COMPUTER AIDED DESIGN AND ANALYSIS LAB	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Introduction to computer Aided Design and Drafting packages. 2D – Drawing using Auto CAD
2. Basic commands in AUTOCAD-Utility, draw, modify, and display commands. 2D sectional views, part drawing, assembly drawing, detailed drawing.
3. Dimensioning, annotations, symbols – Welding, Surface finish, threads, Text, Bill of Materials, Title Block.
4. Exercises – Knuckle joint, Gib & Cotter joint, Screw Jack, Foot step bearing. Orthographic views, Isometric views.
5. Solid modeling features-Boolean operations.

Structural analysis of beams with different boundary conditions using FEA software

Total Hours: 45

SubjectCode: BME18OL3/ BME20OL3	Subject Name: MECHANICAL MEASUREMENTS & METALLURGY LAB	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	**Lb**	**0**	**0/0**	**3/0**	**1**

L : Lecture T:Tutorial SLr : Supervised Learning P : Project R : Research C:Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

OBJECTIVES: Students will learn

- Linear and angular measurement methods
- Calibration of measuring instruments
- Micro structures of various ferrous and non ferrous materials using microscopes.
- Heat treatment processes of materials.

course outcomes (cos) : (3- 5)	
CO1	Understand and apply the various instruments for linear measurements.
CO2	Understand and apply the various instruments for angular measurements.
CO3	Recent advances in metrology & Practical skill in handling precision instruments
CO4	Knowledge of microstructure analysis of ferrous and non-ferrous materials
CO5	Knowledge of various heat treatment process.

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	2	2	2	2	2			2
CO2	3	2	2	1	2	2	2	2	2			2
CO3	3	2	2	1	2	2	2	2	2			2
CO4	3	2	2	1	2	2	2	2	2			2
CO5	3	2	2	1	2	2	2	2	2			2

Cos / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**				
CO1		2	2	3				
CO2		2	2	3				
CO3		2	2	3				
CO4		2	2	3				
CO5		2	2	3				

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Open Elective Lab/ Practical		
										✓		

SubjectCode: **BME18OL3/ BME20OL3**	**Subject Name:** **MECHANICAL MEASUREMENTS & METALLURGY LAB**								**Ty / Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: Nil								**Lb**	**0**	**0/0**	**3/0**	**1**

MEASUREMENTS LAB EXPERIMENTS

1. Measurement of Dimensions using Vernier HeightGauge
2. Measurement of Dimensions using Vernier DepthMicrometer
3. Measurement of Gear Nomenclature using Gear ToothVernier
4. Angular Measurement using Vernier Height Gauge and SineBar
5. Angular Measurement using Sine Bar, Slip Gauge and DialGauge
6. Thread Measurement using ProfileProjector
7. Measurement of Dimensions using Tool MakersMicroscope
8. Angular measurement using BevelProtractor
9. Calibration of Dial Gauge using SlipGauge
10. Flatness of given work piece usingAutocollimator

STUDY EXPERIMENTS

1. Introduction tometallurgy
2. Specimenpreparation
3. Metallurgical microscope
4. Iron carbonsystem
5. Time temperature transformation diagram(TTT)

MICROSTRUCTURE ANALYSIS

1. Brass
2. Copper
3. Graycast-iron
4. Malleablecast-iron
5. Nodular iron
6. Mild-steel, Stainless-steel and High speedsteel

HEAT TREATMENT PROCESS

1. Jominey quenchtest
2. Hardness ofsteel
3. Creeptest

Total Hours: 45

Dr APJ Abdul Kalam Center for Research

Dr.A.P.J Abdul Kalam CoE in Innovation & Entrepreneurship

Subject Code :	Subject Name :	Ty/Lb/ ETL	L	T/ SLr	P/ R	C
BMG18OE1/ BMG20OE1/ BMG13E12/ BMG20E12	**TECHNICAL ENTREPRENEURSHIP**					
	Prerequisite : None	ETL	2	0/ 1	2/ 0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES : At the end of the course the learner will be able to

- **Identify their flow & run interview to understand customers views.**
- **Do market analysis & create solutions for the identified problems**
- **Differentiate start up and small business & Understand the basics of lean approach**
- **Study the expectations of customers and investors, and interpret the revenue streams**
- **Articulate an effective pitch and understands how to manage risks.**

COURSE OUTCOMES (Cos) : (3 – 5)Students completing the course were able to

CO1	**Identify Business Opportunity, Understand Problems & Provide solutions & carry out Design Thinking Process.**
CO2	**Differentiate Customer & Consumer and prepare Value proportion canvas, types of Business models**
CO3	**Interpret Industrial needs, carry out competitive analysis & perform product market fit test**
CO4	**Analyze primary & secondary revenue streams & opt for different pricing strategies**
C05	**Compose positioning statement for the product & build digital presence, planning & budgeting**

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						2			2			2
CO2	3	3	3	3	3	3	2		3	2	3	
CO3	3	3	3	2	2	2				2	1	
CO4	2		2		2	1		3		3		
CO5	3	3	3	3	3	2			2	2		

Cos / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1		2	2					
CO2		2	2					
CO3		2	2					
CO4		2	2					
CO5		2	2					

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

Subject Code : BMG18OE1/ BMG20OE1/ BMG13E12/ BMG20E12	Subject Name : **TECHNICAL ENTREPRENEURSHIP**	**Ty/ Lb/ ETL**	**L**	**T/ SL r**	**P/ R**	**C**
	Prerequisite : None	ETL	2	0/ 1	2/ 0	3

UNIT –I DISCOVER YOURSELF & IDENTIFY PROBLEMS WORTH SOLVING 9 hrs

Effectuation – Find your flow – Entrepreneurial style – How to identify Business opportunity - find problems worth solving – Methods of finding & understanding problems - How to run problem interview to understand customer's world view – Design thinking – Process & examples – Idea Generation (DISRUPT) – GOOTB

UNIT –II CUSTOMER SEGMENT, VALUE PROPORTION & LEAN CANVAS 9 hrs

Difference between consumer and customer – Market types – Segmentation & Targeting – Defining the personas – understanding early adopters & customer adoption pattern – early innovators for startups – creative solutions for identified problems – Deep dive into gains, pains & jobs to be done (value proportion canvas) – identify UVP using VPC – outcome driven innovation (I min customer pitch) – Basics of Lean approach & Canvas – Types of business models.

UNIT –III SIZING THE OPPURTUNITY & MVP 9 hrs

Introduction to risks –Documents & assumptions – Build solution – Does the solution solve customer problems – Problem – solution test – Difference between a start up venture & small business – industry analysis – competition analysis – Blue ocean strategy – building MVP (document & validation of assumptions – lean feedback loop & MVP/Javelin board – MVP interviews – product market fit test

UNIT –IV REVENUE STREAMS 9 hrs

Basics of how companies make money – income, cost, gross and net margin – primary and secondary revenue streams – value, price & costs – different pricingstrategies – product costs & unit costs – basics of unit costs – finance for business ideas – various sources of funds & its pros and cons – investor expectations – pitching to investors & corporates – shared leadership – role of good team venture's success – roles & responsibilities – pitch a candidate to join a start up – collaboration tools and techniques

UNIT – V MARKETING & SALES 9 hrs

Difference between product brand & link between them – positioning statement for the product – building digital presence and leveraging social media – creating company profile page – measure effectiveness of selected channels – budgeting and planning – sales planning – targets – USP – art of sales pitch - follow up and closing sale – importance of project management – work flow – delegation of tasks – basics of business regulationsof starting and operating business – compliance and proper documentation.

PRACTICAL COMPONENT : CAPSTONE PROJECT PRESENTATION & EVALUATION

ADDITIONAL SKILL REQUIREMENT :ONE MODULE THROUGH UEDEMYSUCH AS PYTHON OR .ASP OR ROBOTICS OR ANY OTHER COURSE THAT IS DEEMED ESSENTIAL.

TotalHours : 45

Subject Code : BMG18OE2/ BMG20OE2	Subject Name :**ADVANCED PROGRAM IN ENTREPRENEURSHIP**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/ R**	**C**
	Prerequisite : WF201	ETL	2	0/ 1	2/ 0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory / Lab / Embedded Theory and Lab

OBJECTIVES :

- **Understand basics of budgeting and planning**
- **Relook the problem statement and refine the solution**
- **Understand the need for sales pitching**
- **Analyze optimizing cost and operational expenses**
- **Identify the financial, technological needs to develop the business**

COURSE OUTCOMES (Cos) : (3 – 5)
Students completing the course were able to

CO1	**Revisit their business models and improve their business ideas.**
CO2	**Explore various revenue streams, new channels & partnerships**
CO3	**Test the price elasticity & analyze financial modeling**
CO4	**Understand how to build teams beyond founders**
C05	**Use technology to build and grow business**

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO 1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2		3		3	3		1
CO2			3	2			2				3	
CO3				3		2					3	
CO4			3	2	2	2	2	2	3			1
CO5	3		3	2	3	2		1		3		2

Cos/PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**				
CO1		2	2					
CO2		2	2					
CO3		2	2					
CO4		2	2					
CO5		2	2					

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
							√		

Subject Code : BMG18OE2/ BMG20OE2	Subject Name :**ADVANCED PROGRAM IN ENTREPRENEURSHIP**	**Ty/Lb/ ETL**	**L**	**T/ SL r**	**P/ R**	**C**
	Prerequisite : WF201	ETL	2	0/ 1	2/ 0	3

UNIT –I GROWTH, EXPANSION & SCALING 9 hrs

Growth stage and start up phase – revisiting business model and develop few variants – additional customer segments – evaluation of business models for new customer segments – relook of problem statement and repositioning for scalability – additional ways to monetize.

.

UNIT –I SCALING & STRATEGY 9 hrs

Gain traction beyond early customer – defining and measuring traction – cost of new customer acquisition – customer life time value – identify wastes and what's important for traction – bullseye framework – identifying channels – measurement of effectiveness of selected channels

UNIT –III SALES PLANNING 9 hrs

Budgeting & Planning – stabilizing key revenue streams – additional revenue streams – exploring new channels and partnerships – sales planning and setting targets – unique sales proportion – art of sales pitch – building a professional team – sales compensation and incentives

UNIT – IV FINANCIAL MODELLING 9 hrs

testing price elasticity – optimizing cost and operational expenses – advanced concepts in unit costing – financial modeling of venture growth – analyzing competitor and peer's financial models – various sources of funding – investors and lenders expectations - pitch practice – Building teams beyond founders – basics of compensation, incentives and stock options

UNIT – V TECHNOLOGY PLANNING 9 hrs

Identify technology needs – cost of using technology to build and grow the business – Technology as a differentiator and competitive weapon – overview of legal issues – importance of getting professional help – importance of being compliant and keeping proper documentation – patents and intellectual property - trademarks

PRACTICAL COMPONENT : CAPSTONE PROJECT – PITCH YOUR VENTURE

Total Hours: 45 Hrs

Open Electives-ECE

Subject Code: BEC18OE1/ BES20OE1	**Subject Name :Internet of Things and its Applications**	**Ty / Lb/ ETL**	L	T/SLr	P/R	C
	Prerequisite:	Ty	3	0/0	0/ 0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study basics of IoT.
- To study IoT with Cloud environment.
- To study IoT applications.

COURSE OUTCOMES (COs) : (3- 5)
The students will be able to

CO1	Explore basics concepts of technology of IoT
CO2	Understand different IoT domains.
CO3	Manage system data in cloud environment
CO4	Interface embedded system with IoT
CO5	Learn new applications based on IoT.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	2	3	2	2	2	3	3
CO2	3	2	2	3	3	2	2	2	2	2	3	3
CO3	3	2	3	3	3	2	2	2	2	2	3	3
CO4	3	3	2	3	3	2	2	2	1	2	3	3
CO5	3	2	3	3	3	2	2	2	1	2	3	3

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3
CO2	3	3	2	3
CO3	3	3	2	3
CO4	3	3	2	3
CO5	2	3	1	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Soft Skills	Category	Basic Sciences	Engg Sciences
						√					

Subject Code: BEC18OE1/ BES20OE1	**Subject Name : Internet of Things and its Applications**							**Ty / Lb/ ETL**	L	T/SLr	P/R	C
	Prerequisite:							T	3	0/0	0/ 0	3

UNIT I INTRODUCTION TO INTERNET OF THINGS 9 Hrs

Definition and Characteristics of IoT – Things in IoT – IoT Protocols – Logical Design of IoT – IoT enabling technologies – IoT Levels.

UNIT II DOMAIN SPECIFIC IoT 9 Hrs

Home Automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health and Life style–SDN and NFV for IoT.

UNIT III IoT SYSTEM MANAGEMENT AND CLOUD 9Hrs

Need for IoT System Management - SNMP – NETOPEER – IoT design methodology - Xively – Django- Amazon Web for IoT – SkyNetIoT.

UNIT IV IoT PHYSICAL DEVICES 9Hrs

Raspberry Pi - Raspberry Pi Interfaces – Arduino boards – Other IoT devices –Intel Galileo Arduino board Specification.

UNIT V IoT APPLICATIONS 9 Hrs

Applications based on IoT - Smart Cities -Smart Home and Buildings -Smart Energy and the Smart Grid - Smart Health- Smart Transportation and Mobility

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Hours: 45

Textbooks:

1. ArshdeepBahga.Vijaymadisetti ,*" Internet of things – A hands- on approach* " , Universities press, First Editon, 2015.
2. Adrian McEwen and Hakim Cassimally, "*Designing the Internet of Things*",Wiley,First edition 2014.
3. C HillarGastn, "*Internet of Things with Python*",Packt publishing, first edition ,2016.

Reference Books:

1. *Dominique D. Guinard and Vlad M. Trifa "Building the Web of Things With examples in Node.js and Raspberry Pi",June 2016 ISBN 9781617292682*
2. *CharalamposDoukas, "Building Internet of Things with the Arduino" ISBN/EAN13:1470023431 / 9781470023430*
3. *Gastón C. Hillar, "Internet of Things with Python", May 2016 , PACKT Publishing limited.*
4. *Marco Schwartz "Internet of Things with the Raspberry Pi: Build Internet of Things Projects Using the Raspberry Pi Platform", Kindle Edition.*

Subject Code: BEC18OE2/ BES20OE2	Subject Name : Cellular Mobile Communication	Ty /Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication system, Computer Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- It deals with the fundamental cellular radio concepts such as frequency reuse and hand off.
- It presents different ways to radio propagation models and predict the large scale effects of radio propagation in many operating environment.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Interpret basic concepts in mobile communication.
CO2	Apply the concepts in establishing a PSTN.
CO3	Recognize basic concepts in cellular technology.
CO4	Analyze different propagation models for improving system coverage.
CO5	Examine the latest wireless systems and standards.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	3	3	3	1	3	1	2
CO2	3	3	3	1	2	2	2	3	2	2	2	2
CO3	3	3	3	3	3	3	1	1	3	3	2	3
CO4	3	3	3	3	3	3	3	2	3	3	3	3
CO5	3	3	3	2	3	2	3	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	**2**
CO2	3	3	2	**2**
CO3	3	3	3	**3**
CO4	3	3	2	**3**
CO5	3	3	3	**3**

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships /	Soft Skills	Category		
						√						

Subject Code: BEC18OE2/ BES20OE2	Subject Name : Cellular Mobile Communication	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite: Communication system, Computer Networks	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO MOBILE COMMUNICATION 9 Hrs

History and Evolution of mobile radio system – Types of mobile wireless system/services – Paging, cellular, WLL , FTTH, Wi-Fi, and Future trends in Personal wireless system.

UNIT II PSTN TECHNOLOGY 9 Hrs

Difference between simplex, half-duplex and duplex transmissions – basic understanding of telephone set – history and evolution of Central Exchange Switching – Operator Switch Boards (PBX) – intraoffice and interoffice calls – Extended Area Service (EAS) – circuit switching, packet switching & TDM switching – DTMF signaling – dial register – in band & out-of-band signaling.

UNIT III CELLULAR CONCEPT 9 Hrs

Structure of a cell – Basic cellular terminologies – Principle of Frequency Reuse – Principle of Channel assignment and its types – Types of channel interference – Different types of handoff strategies

UNIT IV INTERFERENCE AND MOBILE RADIO COMMUNICATION 9 Hrs

Interferences in Cellular Systems – Methods to improve cell coverage - Free space propagation model, reflection, diffraction, scattering, link budget design, Outdoor Propagation models and Indoor propagation models

UNIT V WIRELESS SYSTEMS AND STANDARDS 9 Hrs

GSM, IS-95, DECT, AMPS, GPRS, UMTS, WLAN, WPAN, WMAN, Ultra Wideband communications, 4G/LTE and beyond 4G.Telecom standards and wireless standards.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Hours: 45

TEXT BOOKS

1. Marion Cole, “Introduction to Telecommunications: Voice, Data and Internet”, Pearson Education, 2nd edition, 2008.
2. Anu A. Gokhale, “Introduction to Telecommunications”, Delmar, 2nd edition, 2005.
3. T.S. Rappaport, "Wireless Communication, Principle and Practice", Prentice Hall, NJ, 1996
4. Roy Blake," Wireless Communication technology", Thomson Learning, 1st Edition 2001

REFERENCES

1. *Pete Moulton, Jason Moulton, “The Telecommunication Survival Guide”, Pearson Education, 2001.*
2. *Roger L. Freeman, “Telecommunication System Engineering”, Wiley-India, 4th edition, 2004.*
3. *W.C.Y.Lee, “Mobile Communication Engineering”, (2/e), McGraw- Hill, 1998.*
4. *Dharma P. Agarwal," Introduction to wireless and Mobile systems", Thomson Learning, II Edition, 2006*

Subject Code: BEC18OE3/ BES20OE3	Subject Name : Satellite and its Applications	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn the basics of spacecraft subsystem
- To understand the operation of domestic satellite system
- To apply the principle of satellite in remote sensing technology

COURSE OUTCOMES (COs) :
The students will be able to

CO1	Understand the principle of orbital mechanics
CO2	Understand the elements of satellite system
CO3	Analyze the various domestic satellite systems
CO4	Apply the concepts in designing earth station
CO5	Appraise the applications of satellites in remote sensing

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2		3				2	3	
CO2	3	3					3		3			2
CO3	3					2		3		3		
CO4	3		3		2							3
CO5	3			3					2			

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3		2	
CO2	3	3		2
CO3	3		2	
CO4		3		3
CO5	3			3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills			
						√						

Subject Code: BEC18OE3/ BES20OE3	Subject Name :Satellite and its Applications	Ty /Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

UNIT I ELEMENTS OF ORBITAL MECHANICS 9 Hrs

Kepler's laws of planetary motion - Newton's laws of gravitation- Orbital Equation- Orbital Elements- Orbital Perturbation; Tracking and Orbital Determination- Orbital Correction / Control

UNIT IIELEMENTS OF SATELLITE SYSTEM 9 Hrs

Space Environment- Spacecraft Configuration- Spacecraft Subsystem- Payload- Reliability Consideration – Spacecraft Integration and Testing.

UNIT III DOMESTIC SATELLITE SYSTEMS AND LAUNCH VEHICLES 9 Hrs

The INSAT System- International System: INTELSAT- IMMARSAT- Satellite Based Personal Communication- LEO- MEO- GEO Systems- PSLV and GSLV

UNIT IVEARTH STATION DESIGN 9 Hrs

Earth Station Configuration- Receiver and Transmitter Subsystems- Terminal Equipment: Telephone / Video Interface-Echo Suppressor- FM Digitizers- Elements of Frequency Co-ordination and Control.

UNIT VAPPLICATIONS OF SATELLITES 9 Hrs

Satellite Broadcasting- Satellite TV Systems.Remote sensing satellites - satellite remote sensing in various important areas- such as environmental issues- agriculture- forestry- urban issues and water management - usage of satellite data models in remote sensing- analysis of data from various climate zones and applications in research and society.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Hours: 45Hrs

TEXT BOOKS:

1. T. Pratt and C.W. Bostian, "*Satellite Communication*" John Wiley & Son- 1986.
2. A. Abdul Namith, "*Satellite Communication*" Lakshmi Publications.

REFERENCES:

1. *B.N. Agarwal, "Design of Geosynchronous Spacecraft" ,prentice Hall- 1986.*
2. *D. Roddy, "Satellite Communication" , Prentice Hall- 1989.*
3. *M. Richharia "Satellite Communication Systems Design Principles" Macmillan Press Ltd.Second Edition 2003.*
4. *http://www.ceinsys.com/blog/applications-of-satellite-imagery-remote-sensing-data/*

Subject Code: BEC18OE4 /BES20OE4	Subject Name :Fundamentals of Sensors	Ty / Lb/ ETL	L	T/S Lr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Tounderstandbasic fundamentals of sensor.
- To study sensor characteristics.
- To understand sensor properties of elements.

COURSE OUTCOMES (COs) :
The students will be able to

CO1	Interpret basics of sensors.
CO2	Recognize sensor characteristics.
CO3	Demonstrate sensor properties.
CO4	Explain principles of sensing.
CO5	Study various sensor elements.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	2	3	3	2	1	2	1	1	2	2	2
CO2	3	2	2	3	2	1	2	1	2	2	2	2
CO3	3	2	2	2	2	2	2	1	2	2	2	3
CO4	2	2	2	2	2	1	1	2	1	2	2	3
CO5	2	2	2	2	2	1	1	2	1	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	2	2	3
CO3	3	3	2	3
CO4	3	3	2	3
CO5	2	2	3	3

3/2/1 indicatesM Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

Subject Code: BEC18OE4 /BES20OE4	Subject Name :Fundamentals of Sensors	Ty / Lb/ ETL	L	T/S Lr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

UNITI SENSOR FUNDAMENTALS9 Hrs

Basic Sensor Technology - Sensor Systems - Sensor Characteristics - Signals, and Systems - Sensor Classification

UNITII SENSOR CHARACTERISTICS 9 Hrs

Transfer Function - Span (Full-Scale Input) - Full-Scale Output – Accuracy- Calibration --Calibration Error – Hysteresis – Nonlinearity - Saturation

UNITIII SENSOR PROPERTIES 9 Hrs

Repeatability - Dead Band – Resolution -Special Properties - Output Impedance - Excitation .- Dynamic Characteristics - Environmental Factors - Reliability

UNITIV PHYSICAL PRINCIPLES OF SENSING9 Hrs

Electric Charges, Fields, and Potentials - Capacitance – Magnetism – Induction – Resistance - Piezoelectric Effect -

UNITV SENSOR ELEMENTS9 Hrs

Mechanical Elements - Thermal Elements - Electrical Elements - Application Characteristic - Uncertainty

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Hours: 45

TEXTBOOKS:

.

1) Jacob Fraden, “Handbook Of Modern Sensors Physics, Designs, And Applications”
2) Jon S. Wilson,” Sensor Technology Handbook

REFERENCEBOOKS:

1*) Ian Sinclair , “ Sensors and Transducers” eBook ISBN: 9780080516998*
Hardcover ISBN: 9780750649322

Subject Code: BEC18OE5/ BES20OE5	Subject Name :Basics of Microprocessor and Microcontroller	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study the architecture, addressing modes, and assembly language program of 8085 microprocessor.
- To understand the concepts of different peripherals and their applications
- To learn the functions of 8051 microcontroller.

COURSE OUTCOMES (COs) :
The students will be able to

CO1	Write assembly language program in 8085 and 8086 and understand the design of advanced processors.
CO2	Show their ability to interface peripherals with microprocessors
CO3	Done the inferenceof advanced peripheral with 8085.
CO4	Demonstrate their skills in writing an ALP in 8051.
CO5	Apply their understanding to do a project to develop an application using8085.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	3		-		2	2	-
CO2	3	3	3	3	3	3		2		2	2	2
CO3	2	2	2	2	3	3	2	3		2	3	2
CO4	3	3	3	3	3	-	2	3		2	-	3
CO5	3	2	-	2	2	2	3	-	3	2	3	3

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	
CO2	3	3		2
CO3	2	3		
CO4	3	2		3
CO5			2	3

3/2/1 indicatesM Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						√						

Subject Code: BEC18OE5/BES20OE5	Subject Name :Basics of Microprocessor and Microcontroller	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

UNIT-I 8085 CPU 9 Hrs

Internal Architecture of 8085 microprocessor – Instruction set – Addressing modes – 8085 interrupts – Timing diagram – Assembly level programming.

UNIT II PHERIPHERALS INTERFACING 9 Hrs

USART (8251) – Programmable interval timer (8353/8254) programmable peripheral interface (8255) – CRT controller (8275/6845) – Floppy disk controller (8272).

UNIT III ADVANCED PHERIPHERALS INTERFACING 9 Hrs

Programmable DMA controller (8257) – Programmable Interrupt controller (8259) – Keyboard display interface (8279) – ADC/DAC interfacing.

UNIT IV8051 MICROCONTROLLER 9 Hrs

8051 Microcontroller hardware and Architecture –I/O pins, Ports and circuits–Counters and Timers-Serial Data I/O – Interrupts - 8051 Instruction set – Addressing Modes –Assembly Language Programming.

UNIT V 8085 APPLICATIONS 9 Hrs

Typical application of 8085 – Stepper motor controls – Traffic light controls – waveform generation – Analog interfacing and industrial control – Microcomputer based system with seven segment displays and switches.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Hours: 45

TEXT BOOKS :

1. Ramesh s. Gaonkar, Microprocessor Architecture Programming and Applications with 8085. Fourth edition, Penram international publishing 2000.
2. Douglas V. Hall, microprocessor and interfacing, programming and hardware, Tata McGraw Hill, second edition 1999.

REFERENCES:

1. *A.K.Ray and K.M.Burchandi ,"Intel Microprocessors Architecture Programming and Interfacing" McGraw Hill International edition, 2000.*
2. *Kenneth Jayala, "The 8051 Microcontroller Architecture Programming andAapplication" ,2nd edition ,Penram International publishers (India), New Delhi,1996.*
3. *M.RafiQuazzaman, "Microprocessors Theory and Applications", Intel and Motorola prentice Hall of India , Pvt. Ltd., New Delhi, 2003*

Subject Code: BEC18OE6/ BES20OE6	Subject Name :Industry 4.0 Concepts	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Students will demonstrate an understanding of the fundamentals of the core areas in Industry 4.0.
- Students will gain deep insights into how smartness is being harnessed in industries

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the opportunities and challenges in the fourth industrial revolution.
CO2	Describe, discuss and relate IoT techniques adopted for an industry.
CO3	Demonstrate the importance of various technologies involved in enabling industry 4.0.
CO4	Analyze the power of Cloud Computing in a networked economy.
CO5	Interpret technologies available in IoT.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	3	3	3	3	3	2	3	3
CO2	3	2	2	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	3	3	3	3	3	3	3	3
CO5	2	2	3	3	3	3	3	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	2	2	3	3				
CO2	2	2	3	3				
CO3	3	3	3	3				
CO4	2	2	3	3				
CO5	2	2	3	3				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships /	Soft Skills			
						√						

Subject Code: BEC18OE6/ BES20OE6	Subject Name :Industry 4.0 Concepts	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Ty	3	0/0	0/0	3

UNIT I Introduction to Industry 4.0 9 Hrs

The various Industrial Revolutions – Digitalization and the Networked Economy – Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 – The Journey so far: Developments in USA, Europe, China and other countries – Comparison of Industry 4.0 Factory and Today's Factory – Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

UNIT II Road to Industry 4.0 9 Hrs

Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services – Smart Manufacturing – Smart Devices and Products – Smart Logistics – Smart Cities – Predictive Analytics

UNIT III Technologies for enabling Industry 4.0 9 Hrs

Cyber physical systems – Robotic Automation and Collaborative Robots – Support System for Industry 4.0 – Mobile Computing – Related Disciplines – Cyber Security.

UNIT IV Resources 9 Hrs

Resource- based view of a firm – Data as a new resource for organizations – Harnessing and sharing knowledge in organizations – Cloud Computing Basics – Cloud Computing and Industry 4.0 – Smart Factories

UNIT V IoT Technologies 9 Hrs

Industry 4.0 laboratories –IIoT Reference Architecture – Designing Industrial Internet Systems – Examining the Middleware Transport Protocols – IIoT WAN Technologies and Protocols - Securing the Industrial Internet.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Hours: 45

TEXT BOOKS:

1. Alp Ustundag and Emre Cevikcan, "*Industry 4.0: Managing the Digital Transformation*", Springer Series in Advanced Manufactruing.
2. Alasdair Gilchrist, "*Industry 4.0: The Industrial Internet of Things*", Apress Publications.

REFERENCES:

1. *Rajesh Agnihotri and Samuel New, "Industry 4.0 Data Analytics" , Createspace*Independent Pub (US)

OPEN LAB

Subject Code: BEC18OL1/BEC20OL1	**Subject Name :Sensors and IoT Lab**	**Ty / Lb/ ETL**	L	T/SLr	P/R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- **To design experiments based on sensor with IOT.**
- **To design experiments based on IOT with cloud environment.**

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Implement C source code to interface sensors with IOT.
CO2	Design simple projects using different types sensors.
CO3	Interface sensor date with cloud environment.
CO4	Implement using sensors an application.
CO5	Design new applications using different sensors.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	1	2	1	2	2	3	3
CO2	3	2	2	3	3	1	2	1	2	2	3	3
CO3	3	2	3	3	3	1	2	1	2	2	3	3
CO4	3	2	2	3	3	2	2	1	2	2	3	3
CO5	3	2	3	3	3	1	2	1	2	2	3	2

COs /PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**				
CO1	3	3	2	3				
CO2	3	3	2	3				
CO3	3	3	2	3				
CO4	3	3	1	3				
CO5	3	3	1	3				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	**Basic Sciences**	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							√					

Subject Code: BEC18OL1/ BEC20OL1	Subject Name : Sensors and IoT Lab	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. To familiarize with Intel Galileo Gen2 board and understand the procedure of creation and compilation of C source code. (Pre-Loaded Examples)
2. Write a code to control the Brightness of LED usingIntel Galileo Gen 2 board.
3. To write C source code to Interface Temperature Sensor with Intel Galileo Gen 2 and display the temperature on serial Monitor.
4. To write C source code to Interface Humidity Sensor with Intel Galileo Gen 2 and display the temperature on serial Monitor.
5. Interface Motion sensor, with Intel Galileo Gen 2 to give alert when motion is detected.
6. To write C source code to Interface Sound Detector with Intel Galileo Gen.
7. To write C source code to Interface accelerometer with Intel Galileo Gen 2 and display the values in serial monitor.
8. To write C source code to Perform Gas Sensor Interfacing with Intel Galileo Gen2 Board.
9. To Interface a Flame and Smoke sensor with Intel Galileo Gen 2 in cloud service.
10. Design a smart Lighting system using Light sensor, Motion sensor and indicate the status of the light in cloud service.

Subject Code: BEC18OL2/ BEC20OL2	Subject Name :Robotics Control Lab	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand the different robotic configurations and their subsystems.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Built simple robots using motor driver IC and sensor module.
CO2	Apply programming knowledge to interface various devices with arduino.
CO3	Design robots using timer and delay
CO4	Develop and measure the performance of robots.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2	2	3	2	1	2
CO2	3	3	3	3	3	1	2	2	3	1	2	2
CO3	3	3	3	2	3	2	2	1	3	2	2	2
CO4	3	3	3	3	3	1	2	2	3	1	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	3	2	3
CO3	3	2	2	3
CO4	3	2	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Subject Code: BEC18OL2/ BEC20OL2	Subject Name :Robotics Control Lab	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Simple Robot circuit
2. Build a Light-Tracking Robot
3. Simple Insect Robot
4. Line follower Robot
5. Two-Legged Walking Robot
6. Robot Control using 555 Timer
7. Study of AVR Studio and code Debugging
8. Interfacing Switch to turn on Bar graph LEDs. (Implementing a “Push to ON” indicator)
9. LCD Interfacing to display alphanumeric characters.
10. LCD Interfacing to displaying integer values on the LCD.
11. Generation of delay using timer and turning ‘ON’ the buzzer
12. Indication of the value of counter on LCD
13. DC Motor Interfacing
14. PWM control of the DC motor

Subject Code: BEC18OL3/ BEC20OL3	Subject Name : Basics of MATLAB	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Be familiar with the MATLAB GUI and basic tool boxes
- Be exposed to vector and matrix operations
- Be familiar with arithmetic, logical and relational operations on matrix

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Adopt the MATLAB GUI and basic tool boxes
CO2	Identify vector and matrix operations
CO3	Illustrate withprogramming arithmetic, logical and relational operations on matrix

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	2	2	3	3	3	2
CO2	3	2	3	2	3	1	2	1	3	3	3	2
CO3	3	2	3	3	3	2	2	2	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	3				
CO2	3	3	3	3				
CO3	3	3	3	3				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							√					

Subject Code: BEC18OL3/ BEC20OL3	Subject Name : Basics of MATLAB	Ty / Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite:	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS

1. Introduction to SDK of MATLAB

2. Basic Syntax and scalar arithmetic operations and calculations

3. Working with formulas

4. Arithmetic operations in matrix data

5. Matrix operations (Inverse, Transpose)

6. Reading an image file

7. Reading from and writing to a text file

8. Introduction to toolboxes

9. Data visualization and plotting

10. Relational operators in data

11. Logical operation in data

12. Loops in MATLAB

13. Computing Eigen value for a matrix

14. Random number generation - Monte Carlo methods