Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune

DEPARTMENT OF COMPUTER ENGINEERING
(Regional Language)

Curriculum Structure and Syllabus

of

B Tech Computer Engineering

(Regional Language)

(Regulations 2021)

Effective from Academic Year 2024-25

Institute Vision

To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education.
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with an ability to think and act independently in demanding situations.

EOMS Policy

“We at PCCOE are committed to offer exemplarily Ethical, Sustainable and Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders.

We shall strive for technical development of students by creating globally competent and sensible engineers, researchers and entrepreneurs through Quality Education.

We are committed for Institute’s social responsibilities and managing Intellectual property.

We shall achieve this by establishing and strengthening state-of-the-art Engineering Institute through continual improvement in effective implementation of Educational Organizations Management Systems (EOMS).”

	Pimpri Chinchwad Education Trust's **Pimpri Chinchwad College of Engineering**	
Course Approval Summary		

A) Board of Study - Department of Civil Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	E-Waste Management	BCI7605A / BCI8605A	38-39	
2	Advanced Instrumentation in Infrastructural Engineering	BCI7605B / BCI8605B	40-41	
3	3-D Printing Technique for Construction	BCI7606A / BCI8606A	51-52	
4	Structural Health Monitoring and Audit	BCI7606B / BCI8606B	53-54	

B) Board of study - Department of E &TC

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Bio-Inspired Systems and Computing	BET7601 / BET8601	43-44	
2	Sensors and Automation with IoT	BET7602 / BET8602	45-46	
3	Drone Technology	BET7604 / BET8604	59-60	
4	Advanced Driver Assistance Systems	BET7605 / BET8605	61-62	

C) Board of study - Department of Computer Engineering (Regional Language)

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Cloud Computing	BCER7418 / BCER8418	16-17	
2	Cloud Computing Laboratory	BCER7419 / BCER8419	18-19	
3	Software Testing & Quality Assurance	BCER7420 / BCER8420	20-21	
4	Software Testing & Quality Assurance Laboratory	BCER7421 / BCER8421	22-23	
5	Business Intelligence	BCER7515 / BCER8515	24-25	
6	Advanced Database Systems	BCER7516 / BCER8516	26-27	
7	Virtual Reality / Augmented Reality	BCER7517 / BCER8517	28-29	
8	Computer Vision	BCER7518 / BCER8518	30-31	
9	Network and Application Security	BCER7519 / BCER8519	32-33	
10	Natural Language Processing	BCER7520 / BCER8520	34-35	
11	Project Based Learning - V	BCER7521 / BCER8521	36-37	
12	MOOC Course	BCER7609 / BCER8609	42	
13	Android App Development with Kotlin	BCE7612 / BCE8612	55-56	
14	Agile Project Management	BCE7613 / BCE8613	57-58	
15	Major Project	BCER7701 / BCER8701	67-80	
16	Major Project Stage 1	BCER7702	81-90	
17	Major Project Stage 2	BCER8703	92	

D) Board of study - Department of Mechanical Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS
1	Project Management & Governance	BME7605A / BME8605A	47-48	
2	Industrial Engineering	BME7605B / BME8605B	49-50	
3	Lean Six Sigma	BME7606A / BME8606A	63-64	
4	Professional Ethics	BME7606B / BME8606B	65-66	

Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering

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LIST OF ABBREVIATIONS IN CURRICULUM STRUCTURE

Sr. No.	Abbreviation	Type of Course
1.	BSC	Basic Science Course
2.	ECC	Engineering Core/ Science Course
3.	HSMC	Humanities, Social Sciences and Management Course
4.	PCC	Programme / Professional Core Course
5.	PEC	Programme / Professional Elective Course
6.	OEC	Open Elective Course
7.	PROJ	Project
8.	INTR	Internship
9.	AC	Audit Course
10.	MC	Mandatory Course
11.	LS	Life Skill
12.	PFC	Proficiency Course
13.	MO	MOOC Course
14.	L	Lecture
15.	P	Practical
16.	T	Tutorial
17.	H	Hours
18.	CR	Credits
20.	FA	Formative Assessment
21.	SA	Summative Assessment
22.	TW	Term Work
23.	OR	Oral
24.	PR	Practical

CURRICULUM FRAMEWORK

(2020-2021; 2021-2022; 2022-2023; 2023-2024)

The Course and Credit Distribution

SR. NO.	TYPE OF COURSE	NO. OF COURSES	TOTAL CREDITS	
			NO.	%
1.	Basic Science Course (BSC)	**8**	**23**	**14**
2.	Engineering Core/ Science Course (ECC)	**15**	**22**	**14**
3.	Humanities, Social Sciences and Management Course (HSMC)	**6**	**13**	**8**
4.	Professional Core Course (PCC)	**20**	**48**	**30**
5.	Professional Elective Course (PEC)	**9**	**18**	**11**
6.	Open Elective Course (OEC)	**6**	**18**	**11**
7.	Project (PROJ)	**2**	**16**	**10**
8.	Internship (INTR)	**1**	**3**	**2**
9.	Audit Course (AC)	**3**	**0**	**0**
10.	Mandatory Course (MC)	**2**	**0**	**0**
11.	Life Skill (LS)	**4**	**0**	**0**
12.	Proficiency Course (PFC)	**3**	**0**	**0**
	Total	**79**	**161**	**100**

*** MOOC course is offered under Open Elective Course 5.**

Semester wise Course Distribution

COURSE DISTRIBUTION: SEMESTER WISE										
SR NO	TYPE OF COURSE	NO. OF COURSES / SEMESTER								Total
		1	2	3	4	5	6	7	8	
1.	Basic Science Course (BSC)	3	3	2	-	-	-	-	-	**8**
2.	Engineering Core Course (ECC)	5	6	2	2	-	-	-	-	**15**
3.	Humanities, Social Sciences and Management Course (HSMC)	1	1	1	1	1	1	-	-	**6**
4.	Professional Core Course (PCC)	-	-	4	5	4	4	3	-	**20**
5.	Professional Elective Course (PEC)	-	-	-	-	3	3	3	-	**9**
6.	Open Elective Course (OEC)	-	-	-	1	1	2	2	-	**6**
7.	Project (PROJ)	1	-	-	-	-	-	-	1	**2**
8.	Internship (INTR)	-	-	-	-	-	-	-	1	**1**
9.	Audit Course (AC)	-	-	-	1	1	1	-	-	**3**
10.	Mandatory Course (MC)	-	-	-	-	1	1	-	-	**2**
11.	Life Skill (LS)	1	1	1	1	-	-	-	-	**4**
12.	Proficiency Course (PFC)	-	-	-	1	1	1	-	-	**3**
Total		**11**	**11**	**10**	**12**	**12**	**13**	**8**	**2**	**79**

Semester wise Credit Distribution

CREDIT DISTRIBUTION: SEMESTER WISE										
1 Lecture hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit										
SR NO	TYPE OF COURSE	NO. OF COURSES / SEMESTER								Total
		1	2	3	4	5	6	7	8	
1.	Basic Science Course (BSC)	9	9	5	-	-	-	-	-	**23**
2.	Engineering Core Course (ECC)	7	9	3	3	-	-	-	-	**22**
3.	Humanities, Social Sciences and Management Course (HSMC)	2	2	3	2	2	2	-	-	**13**
4.	Professional Core Course (PCC)	-	-	12	12	8	8	8	-	**48**
5.	Professional Elective Course (PEC)	-	-	-	-	6	6	6	-	**18**
6.	Open Elective Course (OEC)	-	-	-	3	3	6	6	-	**18**
7.	Project (PROJ)	2	-	-	-	-	-	-	14	**16**
8.	Internship (INTR)	-	-	-	-	-	-	-	3	**3**
9.	Audit Course (AC)	-	-	-	-	-	-	-	-	**0**
10.	Mandatory Course (MC)	-	-	-	-	-	-	-	-	**0**
11.	Life Skill (LS)	-	-	-	-	-	-	-	-	**0**
12.	Proficiency Course (PFC)	-	-	-	-	-	-	-	-	**0**
Total		**20**	**20**	**23**	**20**	**19**	**22**	**20**	**17**	**161**

*** MOOC course is offered under Open Elective Course 5.**

Curriculum Structure

BTech Computer (Regional Language)

CURRICULUM STRUCTURE FOR SCHEME - A

Structure for Final Year B.Tech. (Computer Engineering (Regional Language)) Semester – VII

Course Code	Course Type	Course Name	Teaching Scheme				CR		Evaluation Scheme					
			L	P	T	H		FA 1	FA 2	SA	TW	PR	OR	Total
BCER7418	PCC	Cloud Computing	3	-	-	3	3	20	20	60	-	-	-	**100**
BCER7419	PCC	Cloud Computing Laboratory	-	2	-	2	1	-		-	25	-	25	**50**
BCER7420	PCC	Software Testing & Quality Assurance	3	-	-	3	3	20	20	60	-	-	-	**100**
BCER7421	PCC	Software Testing & Quality Assurance Laboratory	-	2	-	2	1	-		-	25	-	-	**25**
BCER7515-17	PEC	Professional Elective Course - 5	2	-	-	2	2	20	20	60	-	-	-	**100**
BCER7518-20	PEC	Professional Elective Course - 6	2	-	-	2	2	20	20	60	-	-	-	**100**
BCER7521	PEC	Project Based Learning - 5	-	4	-	4	2	-		-	50	-	25	**75**
	*OEC	Open Elective Course - 5	3	-	-	3	3	20	20	60	-	-	-	**100**
	OEC	Open Elective Course - 6	3	-	-	3	3	20	20	60	-	-	-	**100**
Total			**16**	**08**	**-**	**24**	**20**							**750**

L-Lecture, **P**-Practical, **T**-Tutorial, **H**-Hours, **CR**-Credits **FA-** Formative Assessment, **SA-** Summative Assessment, **TW**- Term Work, **OR**- Oral, **PR**- Practical

Semester - VII

List of courses – Professional Elective Course - V

Course Code	Course Name	
BCER7515	Business Intelligence	Choose any one
BCER7516	Advanced Database Systems	
BCER7517	Virtual Reality / Augmented Reality	

List of courses – Professional Elective Course – VI

Course Code	Course Name	
BCER7518	Computer Vision	Choose any one
BCER7519	Network and Application Security	
BCER7520	Natural Language Processing	

List of courses – Open Elective Course - V

Course Code	Department	Course Name	
BCI7605A	Civil Engineering	E- waste management	Choose any one
BCI7605B		Advanced Instrumentation in Infrastructural Engineering	
BCER7609	Computer Engineering (Regional Language)	*MOOC	
BET7601	E&TC Engineering	Bio-Inspired Systems and Computing	
BET7602		Sensor and Automation with IoT	
BME7605A	Mechanical Engineering	Project Management & Governance	
BME7605B		Industrial Engineering	

List of courses – Open Elective Course - VI

Course Code	Department	Course Name	
BCI7606A	Civil Engineering	3-D printing technique for construction	Choose any one
BCI7606B		Structural Health Monitoring and Audit	
BCE7612	Computer Engineering	Android App Development with Kotlin	
BCE7613		Agile Project Management	
BET7604	E&TC Engineering	Drone Technology	
BET7605		Advanced Driver Assistance Systems	
BME7606A	Mechanical Engineering	Lean Six Sigma	
BME7606B		Professional Ethics	

CURRICULUM STRUCTURE FOR SCHEME - A

Structure for Final Year B.Tech. (Computer Engineering (Regional Language)) Semester – VIII

Course Code	Course Type	Course Name	Teaching Scheme				CR	Evaluation Scheme					
			L	P	T	H		FA	SA	TW	PR	OR	Total
BCER8801	INTR	Internship	-	-	-	-	3	-	-	100	-	-	**100**
BCER8701	PROJ	Major Project	-	28	-	28	14	-	-	200	-	150	**350**
Total			**-**	**28**	**-**	**28**	**17**						**450**

L-Lecture, **P**-Practical, **T**-Tutorial, **H**-Hours, **CR**-Credits, **FA-** Formative Assessment, **SA-** Summative Assessment, **TW**- Term Work, **OR**- Oral, **PR**- Practical

CURRICULUM STRUCTURE FOR SCHEME - B

Structure for Final Year B.Tech. (Computer Engineering (Regional Language))
Semester – VII

Course Code	Course Type	Course Name	Teaching Scheme				CR	Evaluation Scheme					
			L	P	T	H		FA	SA	TW	PR	OR	Total
BCER7801	INTR	Internship	-	-	-	-	3	-	-	100	-	-	**100**
BCER7701	PROJ	Major Project	-	28	-	28	14	-	-	200	-	150	**350**
Total			**-**	**28**	**-**	**28**	**17**						**450**

L-Lecture, **P**-Practical, **T**-Tutorial, **H**-Hours, **CR**-Credits, **FA-** Formative Assessment, **SA-** Summative Assessment, **TW**- Term Work, **OR**- Oral, **PR**- Practical

CURRICULUM STRUCTURE FOR SCHEME - B

Structure for Final Year B.Tech. (Computer Engineering (Regional Language)) Semester – VIII

Course Code	Course Type	Course Name	Teaching Scheme				CR	Evaluation Scheme						
			L	P	T	H		FA 1	FA 2	SA	TW	PR	OR	Total
BCER8418	PCC	Cloud Computing	3	-	-	3	3	20	20	60	-	-	-	**100**
BCER8419	PCC	Cloud Computing Laboratory	-	2	-	2	1	-		-	25	-	25	**50**
BCER8420	PCC	Software Testing & Quality Assurance	3	-	-	3	3	20	20	60	-	-	-	**100**
BCER8421	PCC	Software Testing & Quality Assurance Laboratory	-	2	-	2	1	-		-	25	-	-	**25**
BCER8515 -17	PEC	Professional Elective Course - 5	2	-	-	2	2	20	20	60	-	-	-	**100**
BCER8518 -20	PEC	Professional Elective Course - 6	2	-	-	2	2	20	20	60	-	-	-	**100**
BCER8521	PEC	Project Based Learning - 5	-	4	-	4	2	-		-	50	-	25	**75**
	*OEC	Open Elective Course - 5	3	-	-	3	3	20	20	60	-	-	-	**100**
	OEC	Open Elective Course - 6	3	-	-	3	3	20	20	60	-	-	-	**100**
Total			**16**	**08**	**-**	**24**	**20**							**750**

L-Lecture, **P**-Practical, **T**-Tutorial, **H**-Hours, **CR**-Credits, **FA-** Formative Assessment, **SA-** Summative Assessment, **TW**- Term Work, **OR**- Oral, **PR**- Practical

"Knowledge Brings Freedom"

Semester - VIII

List of courses – Professional Elective Course - V

Course Code	Course Name	
BCER8515	Business Intelligence	Choose any one
BCER8516	Advanced Database Systems	
BCER8517	Virtual Reality / Augmented Reality	

List of courses – Professional Elective Course – VI

Course Code	Course Name	
BCER8518	Computer Vision	Choose any one
BCER8519	Network and Application Security	
BCER8520	Natural Language Processing	

List of courses – Open Elective Course - V

Course Code	Department	Course Name	
BCI8605A	Civil Engineering	E- waste management	Choose any one
BCI8605B		Advanced Instrumentation in Infrastructural Engineering	
BCER8609	Computer Engineering (Regional Language)	*MOOC	
BET8601	E&TC Engineering	Bio-Inspired Systems and Computing	
BET8602		Sensor and Automation with IoT	
BME8605A	Mechanical Engineering	Project Management & Governance	
BME8605B		Industrial Engineering	

List of courses – Open Elective Course - VI

Course Code	Department	Course Name	
BCI8606A	Civil Engineering	3-D printing technique for construction	Choose any one
BCI8606B		Structural Health Monitoring and Audit	
BCE8612	Computer Engineering	Android App Development with Kotlin	
BCE8613		Agile Project Management	
BET8604	E&TC Engineering	Drone Technology	
BET8605		Advanced Driver Assistance Systems	
BME8606A	Mechanical Engineering	Lean Six Sigma	
BME8606B		Professional Ethics	

CURRICULUM STRUCTURE FOR SCHEME - C

Structure for Final Year B.Tech. (Computer Engineering (Regional Language))
Semester – VII

Course Code	Course Type	Course Name	Teaching Scheme				CR	Evaluation Scheme						
			L	P	T	H		FA 1	FA 2	SA	TW	PR	OR	Total
BCER7418	PCC	Cloud Computing	3	-	-	3	3	20	20	60	-	-	-	**100**
BCER7419	PCC	Cloud Computing Laboratory	-	2	-	2	1	-	-	-	25	-	25	**50**
BCER7420	PCC	Software Testing & Quality Assurance	3	-	-	3	3	20	20	60	-	-	-	**100**
BCER7421	PCC	Software Testing & Quality Assurance Laboratory	-	2	-	2	1	-	-	-	25	-	-	**25**
	*OEC	Open Elective Course - 5	3	-	-	3	3	20	20	60	-	-	-	**100**
BCER7702	PROJ	Major Project Stage - 1	-	14	-	14	7	-		-	100	-	50	**150**
Total			**09**	**18**	**-**	**27**	**18**							**525**

L-Lecture, **P**-Practical, **T**-Tutorial, **H**-Hours, **CR**-Credits, **FA-** Formative Assessment, **SA-** Summative Assessment, **TW**- Term Work, **OR**- Oral, **PR**- Practical

Semester - VII

List of courses – Open Elective Course - V

Course Code	Department	Course Name	
BCI7605A	Civil Engineering	E- waste management	Choose any one
BCI7605B		Advanced Instrumentation in Infrastructural Engineering	
BCER7609	Computer Engineering (Regional Language)	*MOOC	
BET7601	E&TC Engineering	Bio-Inspired Systems and Computing	
BET7602		Sensor and Automation with IoT	
BME7605A	Mechanical Engineering	Project Management & Governance	
BME7605B		Industrial Engineering	

CURRICULUM STRUCTURE FOR SCHEME – C

Structure for Final Year B.Tech. (Computer Engineering (Regional Language)) Semester – VIII

Course Code	Course Type	Course Name	Teaching Scheme				CR		Evaluation Scheme					
			L	P	T	H		FA 1	FA2	SA	TW	PR	OR	Total
BCER8515-17	PEC	Professional Elective Course - 5	2	-	-	2	2	20	20	60	-	-	-	**100**
BCER8518-20	PEC	Professional Elective Course - 6	2	-	-	2	2	20	20	60	-	-	-	**100**
BCER8521	PEC	Project Based Learning - 5	-	4	-	4	2	-		-	50	-	25	**75**
	OEC	Open Elective Course - 6	3	-	-	3	3	20	20	60	-	-	-	**100**
BCER8801	INTR	Internship	-	-	-	-	3	-		-	100	-	-	**100**
BCER8703	PROJ	Major Project Stage - 2	-	14	-	14	7	-		-	100	-	100	**200**
Total			**07**	**18**	**-**	**25**	**19**							**675**

L-Lecture, **P**-Practical, **T**-Tutorial, **H**-Hours, **CR**-Credits, **FA-** Formative Assessment, **SA-** Summative Assessment, **TW**- Term Work, **OR**- Oral, **PR**- Practical

Semester - VIII

List of courses – Professional Elective Course - V

Course Code	Course Name	
BCER8515	Business Intelligence	Choose any one
BCER8516	Advanced Database Systems	
BCER8517	Virtual Reality / Augmented Reality	

List of courses – Professional Elective Course – VI

Course Code	Course Name	
BCER8518	Computer Vision	Choose any one
BCER8519	Network and Application Security	
BCER8520	Natural Language Processing	

List of courses – Open Elective Course - VI

Course Code	Department	Course Name	
BCI8606A	Civil Engineering	3-D printing technique for construction	Choose any one
BCI8606B		Structural Health Monitoring and Audit	
BCE8612	Computer Engineering	Android App Development with Kotlin	
BCE8613		Agile Project Management	
BET8604	E&TC Engineering	Drone Technology	
BET8605		Advanced Driver Assistance Systems	
BME8606A	Mechanical Engineering	Lean Six Sigma	
BME8606B		Professional Ethics	

Course Syllabus

BTech Semester - VII

Program:	B. Tech. (Computer Engineering (Regional Language))	Semester: VII / VIII
Course:	Cloud Computing	Code: BCER7418 / BCER8418

Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	56	100

Prior knowledge of
Data Structure, Databases and Computer Network
is essential.

Course Objectives:

1. To introduce various cloud computing services and models
2. To learn how to select the appropriate configuration for compute node
3. To configure appropriate storage service for the specific application
4. To understand networking and security settings in cloud environment
5. To design the application using high scalability and reliability considerations.

Course Outcomes:

After learning the course, the students will be able to:

1. Classify various cloud computing services and models.
2. Build various computing services in the cloud.
3. Distinguish between various storage-related services used during application development.
4. Select appropriate database service during application development.
5. Choose various networking and security options during application development.
6. Estimate the resource requirements for the application with high availability and reliability features.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Cloud Computing** Distinguishing Cloud Types, Deployment Models, Service Models, Scalability, Virtualization, Software as a service (SaaS): understanding multi-tenant nature, service-oriented architecture, Platform as a service (PaaS): Benefits and disadvantages, Infrastructure as a service (IaaS): Improving Performance Through Load Balancing, System and Storage Redundancy.	08
II	**Compute Services in Cloud Computing** Compute node architecture, parameters to consider while configuring compute node, Machine images, instances, instance types, tags, key pairs, security groups, regions and zones – typesTypes of compute nodes – virtual machines and containers	08
III	**Storage Services in Cloud Computing** Examining the Evolution of Network Storage, Understanding Cloud-Based Data Storage, Advantages and Disadvantages of Cloud-Based Data Storage. Cloud-Based Backup Systems, Understanding File Systems Types of cloud storage – File	08

	Storage, Block Storage – Elastic Block Storage, File Systems, Storage for Backups, Storage for Databases Storage gateway for hybrid cloud storage systems	
IV	**Database Services in Cloud Computing** Need for cloud databases, considerations for cloud databases, architecture and common characteristics, Data Models Relational database (MYSQL), Key – value-based database (DynamoDB), In-memory database, Document based database (MongoDB), Graph based database (Neo4j), Time series database, Ledger based database.	**07**
V	**Networking and Security Services in Cloud Computing** Building cloud network: defining and provisioning isolated networks, gateways in cloud, providing private connectivity in hybrid cloud environments Scaling cloud network: automatic traffic distribution across pool of servers, direct traffic routing for achieving performance Securing network traffic: Configuring and managing firewall rules, access permissions	**07**
VI	**High Availability and Scalability Services in Cloud Computing** Definition, elements of high availability. High availability for compute resources, high availability for databases and high availability for storage services. Regions and availability zones, Auto scaling, Elastic Load Balancing, Reserved instance, Elastic Block Store, EBS snapshots. Scalability issues, vertical scaling vs. horizontal scaling vs. diagonal scaling, difference between scalability and elasticity.	**07**
	Total	**45**

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education, 2018
2. Wittig, Michael, Andreas Wittig, and Ben Whaley. Amazon web services in action. Manning, 2018.
3. Murty, James. Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB, "O'Reilly Media, Inc.", 2008.

Reference Books:

1. Kavis, Michael J. Architecting the cloud: design decisions for cloud computing service models (SaaS, PaaS, and IaaS). John Wiley Sons, 2014.
2. Vacca, John R., ed. Cloud computing security: foundations and challenges. CRC Press, 2016.
3. Furht, Borivoje, and Armando Escalante. Handbook of cloud computing. Vol. 3. New York: springer, 2010.
4. Piper, Ben, and David Clinton. AWS Certified Solutions Architect Study Guide: Associate SAA-C02 Exam. John Wiley Sons, 2020.
5. Anthony, Albert. Mastering AWS Security: Create and maintain a secure cloud ecosystem. Packt Publishing Ltd, 2017.
6. Van Vliet, Jurg, Flavia Paganelli, and Jasper Geurtsen. Resilience and Reliability on AWS: Engineering at Cloud Scale. "O'Reilly Media, Inc.", 2013.
7. Sarkar, Aurobindo, and Amit Shah. Learning AWS: Design, build, and deploy responsive applications using AWS Cloud components. Packt Publishing Ltd, 2018

Web references:

1. Cloud Computing by Soumya Ghosh, https://nptel.ac.in/courses/106105167

Program:	B. Tech. (Computer Engineering(Regional Language))	Semester: VII / VIII
Course:	Cloud Computing Laboratory	Code: BCER7419 / BCER8419

Teaching Scheme				Evaluation Scheme			
Practical	**Tutorial**	**Credit**	**Hours**	**TW**	**PR**	**OR**	**Total**
02	-	01	02	25	-	25	50

Prior knowledge of
Data Structure, Databases and Computer Network
is essential.

Course Objectives:

1. To Study the various computing services in the Amazon AWS cloud.
2. To explore the various cloud computing services and models.
3. To study storage and database, Network and Security services in AWS Cloud.
4. To configure various Amazon AWS services.

Course Outcomes:

After learning the course, the students will be able to:
1. Prepare the different Amazon AWS services.
2. Configure the Amazon AWS storage and database services.
3. Configure the Amazon AWS Network and security, and scalability services.
4. Demonstrate an application on Amazon AWS using all services.

Guidelines for Students:
1. The laboratory assignments are to be submitted by students in the form of a journal.
2. Journal consists of prologue, certificate, table of contents and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept, algorithm, time complexity, sample input and expected output, conclusion)

Guidelines for Laboratory/Term Work Assessment:
1. Continuous assessment of laboratory work is done based on overall performance and Laboratory performance of students.
2. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include timely completion, performance, innovation, efficiency, punctuality and neatness.

Guidelines for Laboratory Conduction
1. All Assignments are mandatory
2. Amazon AWS is open source –use of the services is recommended
3. All Assignments should be conducted as per the sequence.

Suggested List of Assignments

Assignment No.	Assignment Title
I	**First Virtual Machine on AWS** Launch the virtual machine on Amazon AWS and do basic settings

II	**Storage Configuration** Configure the various storages available on AWS and storing, retrieving, deleting the data from those storage applications
III	**Database Configuration** Configure and using various databases available on Amazon AWS
IV	**Networking and Security Services Configuration** Configuring various networking and security options
V	**High availability and scalability services** Configuration of high availability and scalability services
VI	**Mini Project** Implement a project based on all the services studied for a given application on Amazon AWS

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education, 2018.

Reference Books:

1. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013
2. Wittig, Michael, Andreas Wittig, and Ben Whaley. Amazon web services in action. Manning,2018.
3. Murty, James. Programming amazon web services: S3, EC2, SQS, FPS, and SimpleDB." O'Reilly Media, Inc.", 2008.

Program:	B. Tech. (Computer Engineering (Regional Language))	Semester: VII / VIII
Course:	Software Testing & Quality Assurance	Code: BCER7420 / BCER8420

Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Prior knowledge of
Software Engineering
is essential.

Course Objectives:

1. To learn basic concepts of software testing.
2. To understand white box, block box, automation and other testing techniques.
3. To implement testing methods using current tools and techniques.
4. To understand the software quality processes and management.

Course Outcomes:

After learning the course, the students will be able to:

1. Comprehend fundamental concepts in software testing.
2. Use White-box software testing techniques.
3. Apply Black-box software testing techniques.
4. Analyze the software test automation process.
5. Illustrate the process of testing for OOP and web basedapplications.
6. Elaborate the different Software Quality techniques and tools.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction** Goals Of Software Testing, Model For Software Testing, Software Testing Terminology, Software Testing Life Cycle (STLC), Software Testing Methodology, Software Testing Strategy, Test Strategy Matrix, Testing Life Cycle Model, Validation Activities, Defect management process. Software Failure Case Studies	**08**
II	**White-Box Testing Techniques** Dynamic testing vs. static testing, Static Testing: Inspections, Structured Walkthroughs, Technical Reviews. Logic Coverage Criteria, Basis Path Testing, Loop Testing, Data Flow Testing, Mutation Testing	**08**
III	**Black-Box Testing Techniques** Software Testing Techniques, Boundary Value Analysis (BVA), Equivalence Class Testing, State Table-Based Testing, Decision Table- Based Testing, Cause-Effect Graphing Based Testing, Error Guessing	**07**

IV	Introduction to Test Automation, Generic Requirements for Test Tool/Framework, Process Model for Automation, Selecting a Test Tool, Automation for Extreme Programming Model, Selenium Automation Tools: Overview, Web Driver, Selenium RC, IDE, GridAutomation Tools: Appium, Cucumber, SoapUI, Tosca Case study: Execute software test suite	**08**
V	**Testing For Specialized Environments** Issues In Object-Oriented Testing, Strategy And Tactics Of Testing OOS, Testing Of OO Classes, Inheritance Testing, Integration Testing, Challenges In Testing For Web-Based Software, Testing Of Web-Based Systems Any Case study	**07**
VI	**Software Quality Management** Software Quality, Broadening The Concept Of Quality, Quality Control And Quality Assurance, Methods Of Quality Management, Software Quality Metrics, SQA Models	**07**
	Total	**45**

Text Books:

1. Naresh Chauhan, "SOFTWARE TESTING Principles and Practices", OXFORD UNIVERSITY PRESS, 2nd edition 2016
2. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices", Pearson, 2017.

Reference Books:

1. Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press, Dec 2016.
2. Ilene Burnstein, "Practical Software Testing A Process-Oriented Approach", Springer-Verlag New York, Inc., 2006 ISBN 0-387-95131-8

Web references:

1. https://www.selenium.dev/documentation/overview/
2. https://pdfcoffee.com/download/se-4-pdf-free.html

Program:	**B. Tech. (Computer Engineering(Regional Language))**	**Semester: VII / VIII**
Course:	**Software Testing & Quality Assurance Laboratory**	**Code: BCER7421 / BCER8421**

Teaching Scheme				**Evaluation Scheme**			
Practical	**Tutorial**	**Credit**	**Hours**	**TW**	**PR**	**OR**	**Total**
02	-	01	02	25	-	-	25

Prior knowledge of
Software Engineering
is essential.

Course Objectives:

1. To identify the requirements of the system.
2. To understand white box, block box, automation and other testing techniques
3. To implement testing methods using current tools and techniques
4. To understand the software quality processes and management.

Course Outcomes:

After learning the course, the students will be able to:

1. Analyze the requirements for the given problem statement
2. Construct test scenarios, test plan for the application
3. Verify the test cases for the application using automated tool.
4. Select appropriate open source tool to perform defect tracking.

Guidelines for Students:

1. The laboratory assignments are to be submitted by students in the form of a journal.
2. Journal consists of prologue, certificate, table of contents and handwritten/Soft copy(wherever required) write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept, algorithm, sample input and expected output, conclusion)

Guidelines for Laboratory/Term Work Assessment:

1. Continuous assessment of laboratory work is done based on overall performance and Laboratory Performance of students.
2. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include timely completion, performance, innovation, efficiency, punctuality and neatness.

Guidelines for Laboratory Conduction

1. All Assignments are mandatory
2. Use of the open-source automated software testing is recommended
3. All Assignments should be conducted as per the sequence.

Suggested List of Assignments

Assignment No.	**Assignment Title**
1	Create a small application by selecting relevant system environment /platform and programming languages. Prepare a document for Requirements Traceability Matrix for the application.

2	Narrate concise Test Plan consisting features to be tested. Prepare Test Cases inclusive of Test Procedures for identified Test Scenarios.
3	Based on assignment 1 & 2, Perform selective Black-box and White-box testing covering Unit and Integration test by using suitable Automated Testing tools. Prepare Test Reports based on Test Pass/Fail Criteria.
4	Create a small web-based application by selecting relevant system Environment / platform and programming languages. Narrate concise Test Plan consisting Features to be tested and scripts in order to perform regression tests.
5	For any small web-based application perform cross browser testing and user acceptance testing.
6	For above web application, identifythe bugs using Bug/Defect tracking tool and generate bug/defect reports.

Text Books:

1. Naresh Chauhan, "SOFTWARE TESTING Principles and Practices", OXFORD UNIVERSITY PRESS, 2nd edition 2016
2. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices", Pearson, 2017.

Reference Books:

1. Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press, Dec 2016.
2. Ilene Burnstein, "Practical Software Testing A Process-Oriented Approach", Springer-Verlag New York, Inc., 2006 ISBN 0-387-95131-8

Web references:

1. https://www.selenium.dev/documentation/overview/
2. https://pdfcoffee.com/download/se-4-pdf-free.html

Program:	B. Tech. (Computer Engineering(Regional Language))			Semester: VII / VIII			
Course:	Business Intelligence (PEC-5)			Code: BCER7515 / BCER8515			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
02	-	02	02	20	20	60	100

Prior knowledge of
Database Management Systems, Data Science & Big data Analytics, Machine Learning, and Engineering Mathematics
is essential.

Course Objectives:

1. To introduce the concepts and components of Business Intelligence (BI).
2. To develop and Analyze performance of BI Project models using BI tools and Techniques.
3. To describe the BI reporting approaches and to build BI reports.
4. To implement the web and text mining methods.
5. To understand and analyze BI applications in marketing, medical, finance and agriculture.

Course Outcomes:

After learning the course, the students will be able to:
1. Develop and analyze business projects models using BI tools and techniques.
2. Build and manage BI reports.
3. Implement Text and Web mining operations.
4. Explore and analyze various real life BI applications.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Insights of Business Intelligence** Introduction of BI, BI and Datawarehouse, OLAP-OLTP, Decision Support System [DSS] for effective and timely decisions, BI Architecture, Tools for Business Intelligence, Role of analytical tools in BI, Case study of **Analytical Tools** such as WEKA, KNIME.	**08**
II	**Visualization of BI Reports** Case Study of **Visualization Tool**: Power BI; **Visualization**: Charts, Graphs, Widgets, Scorecards and Dashboards, **Types of Reports** – List, crosstabs, Statistics, Chart, map, financial etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional formatting.	**08**
III	**Web and Text Mining** Text data analysis and Information retrieval, text retrieval methods, dimensionality reduction methods **like SVD and PCA** for text. Web Mining: - web content, web structure, web usage.	**07**
IV	**BI Applications** Data Analytics, Business Analytics, BI Applications such as ERP, BI in Inventory Management System, BI in Medical sector, Marketing, Banking	**07**

	&Finance Sector, Agriculture.	
	Total	**30**

Text Books:

1. Fundamental of Business Intelligence, Grossmann W, Rinderle-Ma, Springer, 2015
2. R. Sharda, D. Delen, & E. Turban, Business Intelligence and Analytics. Systems for Decision Support, 10th Edition. Pearson/Prentice Hall, 2015

Reference Books:

1. Business Intelligence: Data Mining and Optimization for Decision Making, Carlo Vercellis, Wiley, 2019.
2. EMC Educational Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley ISBN-13 978 1118876138, 2015

Web references:

1. https://www.knime.com/sites/default/files/inline-images/KNIME_quickstart.pdf
2. www.cs.ccsu.edu/~markov/weka-tutorial.pdf
3. https://download.e-bookshelf.de/download/0000/5791/06/L-G-0000579106-0002359656.pdf
4. https://www.tutorialspoint.com/power_bi/index.html

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Advanced Database Systems (PEC-5)			Code: BCER7516 / BCER8516			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
02	-	02	02	20	20	60	100

Prior knowledge of
Database Management System Basics
is essential.

Course Objectives:

1. Understand the different types of database system architectures.
2. Understand different parallelism techniques for parallel databases.
3. Make the students aware about different distributed transaction processing problems and solutions in order to achieve consistency.
4. Understand the advanced features and functionalities of Cassandra Query Language (CQL).

Course Outcomes:

After learning the course, students will be able to:

1. Discuss the trade-offs and challenges of different database system architectures.
2. Examine different parallelism techniques for parallel databases.
3. Analyze distributed transaction processing problems to provide solutions that ensure the consistency and integrity of data.
4. Apply the Cassandra Query Language (CQL) to manipulate data, create and modify tables, and perform advanced queries.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Database-System Architectures** Centralized and Client-server Architectures, Server System Architectures, Parallel Systems, Distributed Systems	07
II	**Parallel Databases** Architectures, I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Interoperation Parallelism, Interoperation Parallelism, Query Optimization	08
III	**Distributed Databases** Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions, Commit Protocols, Concurrency Control in Distributed Databases- Locking Protocol, Timestamping, deadlock handling. Availability-Majority based approach, Read one, write all available approach	08
IV	**NoSQL Databases** Why NoSQL, introduction to CAP Cassandra, NoSQL Data Models, column store data model, Cassandra: Architecture, relational table Vs Cassandra	07

	column family, use cases, Table operations, CRUD operations, CQL types	
	Total	**30**

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database system concepts”, 7th Edition, McGraw Hill International Edition, ISBN-978-007-128959-7, 2019
2. Eben Hewitt, “Cassandra: The definitive Guide”, O'Reilly Media Inc., 2010.

Reference Books:

1. C. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2. Vivek Misra, "Beginning Apache Cassandra development", Apress Publication, 2014

Web references:

1. https://www.tutorialspoint.com/cassandra
2. https://www.javatpoint.com/cassandra-tutorial

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Virtual Reality / Augmented Reality (PEC-5)			Code: BCER7517 /BCER8517			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
02	-	02	02	20	20	60	100

Prior knowledge of
Computer Graphics and Image Processing
is essential.

Course Objectives:

1. The fundamentals of Virtual Reality and the applications.
2. Concepts of rendering and tracking in Virtual Reality.
3. Components of Augmented Reality system.
4. Augmented Reality Tracking methods.

Course Outcomes:

After learning the course, students will be able to:

1. Comprehend fundamentals of Virtual Reality and the applications.
2. Interpret the concepts of rendering and tracking in Virtual Reality.
3. Explore the essential components of Augmented Reality system.
4. Analyze the tracking methodologies in Augmented Reality systems.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Virtual Reality** Spectrum between real and virtual world, Key elements of VR experience, Interface to VR world - Input and Output, Visual representation of VR world, Applications of VR Case Study: Use of VR in Gaming environment	07
II	**Virtual Reality Rendering** Rendering the Virtual World, Quantitative and Qualitative Representations, Rasterization, Latency and frame rates, Human Perception **Virtual Reality Tracking** Viewing transformations,2D and 3D orientation, locomotion Case Study: Use of 3D modelling, rendering and animation	08
III	**Augmented Reality** Concepts and ingredients of an AR experience, Hardware- Displays, Processors, Tracking and Sensors, Software- Major components to create content for the AR application, study of available AR toolkits Case Study: Design of an AR application using Unity	08
IV	**AR Tracking** Marker based and Markerless Tracking, Types of markers, Tracking methods, AR Devices, Vuforia engine	07

	Case Study: Generating a scene using AR components	
	Total	**30**

Text Books:

1. William R Sherman and Alan B Craig, Understanding Virtual Reality: Interface, Application and Design, Morgan Kaufmann Publishers, San Francisco, CA, ISBN: 9780128010389, 2018.
2. Alan B Craig, Understanding Augmented Reality Concepts and Applications, Morgan Kaufmann Publishers, ISBN: 978-0-240-82408-6, 2013

Reference Books:

1. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009.
2. Schmalstieg / Hollerer, Augmented Reality: Principles & Practice by, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494

Web references:

1. https://nptel.ac.in/courses/106/106/106106138/
2. https://www.coursera.org/learn/introduction-virtual-reality

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Computer Vision (PEC-6)			Code: BCER7518 / BCER8518			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
02	-	02	02	20	20	60	100

Prior knowledge of
Fundamentals of Mathematics, Image and Video Processing, Basic of CNN
is essential.

Course Objectives:

1. To understand the image formation models and color spaces
2. To apply appropriate filtering and segmentation techniques for image processing
3. To understand neural networks and its usage in computer vision.
4. To analyze object detection and recognition methods for suitable applications.

Course Outcomes:

After learning the course, students will be able to:
1. Comprehend computer vision fundamentals and representation of color spaces.
2. Use appropriate image processing methods for suitable applications
3. Apply neural networks for image recognition and detection.
4. Analyze object detection and recognition methods for suitable applications.

Note: Case Studies are not a part of assessment, it's only study purpose.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction** Computer Vision, 2D/3D Vision, Filters, Binary Images, Features, Texture, Shape, Segmentation, Model Fitting and Probabilistic Models representation, color spaces Case Study - 2D to 3D image conversion.	07
II	**Image Processing and Feature Extraction** Image Formation, Image Filtering, Edge Detection, Principal Component Analysis, Corner Detection, SIFT, SURF Case Study - How Tesla uses Cameras and Computer Vision to detect cars for its Self-driving mode	08
III	**Neural Network for Computer Vision** Neural Network, Introduction of CNN for Image Recognition- Kernel, Padding, Aggregation, Feature Map, Activation Functions Case Study - Sparrow - An Autonomous surveillance by Percepto	07
IV	**Object Detection & Recognition** Detection methods – Histogram of Oriented Gradients (HOG), Region-based Convolutional Neural Networks (R-CNN), Hough transforms and other simple object recognition methods, Generative Adversarial Networks (GANs).	08

	Case Study - Face Frontal View Generation.	
	Total	**30**

Text Books:

1. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Publisher Prentice Hall Edition 2nd Edition, 2018.
2. González, R.C.; Woods, R.E. Digital image processing. 3rd ed, Harlow: Pearson Prentice Hall. 2016, ISBN 9780131687288.

Reference Books:

1. Digital Image Processing and Computer Vision,R. J. Schalkoff,John Wiley & Sons Australia Edition, 2008
2. Computer Vision, L. Shapiro, G. Stockman,Prentice-Hall Edition 2012.
3. Introductory Techniques for 3D Computer Vision,E. Trucco, A. Verri, Prentice Hall Edition 2013.

Web references:

1. https://www.analyticsvidhya.com
2. https://towardsdatascience.com
3. https://onlinecourses.nptel.ac.in/

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Network and Application Security(PEC-6)			Code: BCER7519 / BCER8519			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
02	-	02	02	20	20	60	100

Prior knowledge of
Basics of Information Security and Computer Networks
is essential.

Course Objectives:

1. To offer an understanding of the network security, services, attacks, mechanisms, and types of attacks, IP Security and web security protocols
2. To make students understand wireless network security threats.
3. To make students comprehend the knowledge of Firewalls and IDS
4. To make students aware of various Web Application security protocols.

Course Outcomes:

After learning the course, students will be able to:

1. Comprehend various network attacks, and network security protocols to secure a system.
2. Apply different wireless network security and email security protocols to defend attacks.
3. Apply the knowledge of Firewall, and IDS for protecting assets from network attacks.
4. Analyze various web application vulnerabilities.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Basics of Network Security:** **Introduction to Network Security:** Overview, Operational Model of Network Security **Overview of Network Attacks:** Packet Sniffing, IP Spoofing, ARP Poisoning, Denial of Service Attack, Port Scanning Techniques, ICMP echo attack. **IP Security:** Introduction to IPSec, IPSec protocols and Operations, AH Protocol, ESP Protocol, ISAKMP Protocol, Oakkey determination Protocol. **WEB Security:** Introduction, Secure Socket Layer (SSL), SSL Session and Connection, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol.	09
II	**Basics of Wireless Network Security and Email Security:** **Wireless Network Security:** Overview: WEP, WPA, Wireless LAN Threats, Securing Wireless Networks and WPA-2. **Wireless LAN:** IEEE 802.11/802.11i Wireless LAN Security **Electronic Mail Security:** Introduction, Pretty Good Privacy (PGP), MIME, S/MIME **E-Commerce Security:** Secure Electronic Transaction (SET)	07
III	**Basics of Firewall and IDS:** **Firewall:** Introduction, Characteristics, types, benefits, and limitations;	07

	Firewall architecture; Trusted Systems **IDS:** Need, Methods, Types of IDS, Password Management, Limitations and Challenges	
IV	**Basics of Web Application Security:** OWASP; Web Browser Attacks, Clickjacking, Cross-Site Request Forgery, Phishing, and Pharming Techniques, Web Service Security, OAuth 2.0	**07**
	Total	**30**

Text Books:

1. William Stallings, Network Security Essentials: Applications and Standards, 6th Edition, Pearson ISBN 10: 1-292-15485-3 Education, ISBN: 9789352866601, 2017
2. Bernard Meneze, Network Security, and Cryptography, Cengage Learning, ISBN: 978-8131513491, 2010

Reference Books:

1. William Stallings**,** Cryptography and Network Security, Principles and Practice, 6th Edition, Pearson Education, ISBN 13: 9781292158587, 2017
2. Kahate, A**.** Cryptography, and Network Security. McGraw-Hill Higher Ed., ISBN-13:9789353163303, 2019

Web references:

1. https://owasp.org/www-project-top-ten/

Program :	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Natural Language Processing (PEC-6)			Code: BCER7520 / BCER8520			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
02	-	02	02	20	20	60	100

Prior knowledge of
Theory of Computation, Discrete Structure
is essential.

Course Objectives:

1. To introduce fundamental concepts of Natural Language Processing
2. To learn and understand syntax parsing techniques.
3. To implement semantic parsing techniques
4. To develop application using NLP

Course Outcomes:

After learning the course, students will be able to:

1. Explore the fundamentals of natural language processing.
2. Design syntax parsers using word-level processing techniques.
3. Apply semantic parsing techniques to translate natural language into a formal meaning representation.
4. Apply different Natural Language Techniques for machine Translation and Applications.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Natural Language Processing** Introduction, history, NLP system, level of NLP, Two view of NLP and associated challenges, stage of processing, Text Processing: word segmentation, sentence segmentation, corpora and corpora analysis, Morphology: Morphology analysis, Finite state machine for word morphology.	**08**
II	**Word Level Processing and Syntax Parsing** Word level processing: Word sentence tokenization, stemmers, Detect and correct spelling errors, N-grams, Part of Speech Tagging Syntax Parsing: Context Free Grammar (CFG), Syntax Tree, Parsing, ambiguity in parsing, Probability Parsing, CKY algorithm, dependency parsing	**07**
III	**Semantic Parsing** Word net, word sense disambiguation, WSD algorithm, problem of sense tagging, Word sense inductions Semantic role labeling: semantic roles, diathesis alteration, problems with thematic roles, proposition bank, framenet, semantic role labeling, selection restrictions, decomposition of predicates Lexicon for sentiment, affect and connotation	**08**
IV	**Machine Translation and application** Machine translation system, Language divergence, Interlingua based MT,	**07**

	Introduction to BERT Applications: text summarization, Question/Answering system, Chatboat and Dialogue System	
	Total	**30**

Text Books:

1. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", 2nd ed. CRC press, 2010
2. Allen, James, Natural Language Understanding, Eight Edition, Person Publication, 1995.
3. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd Edition, Prentice Hall, 2023.

Reference Books:

1. Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python, Oreilly, 1st edition, 2009.
2. Pushpak Bhattacharyya, Machine Translation, CRC Press, 2017.
3. Martin Whitehead, Handbook of Computational Linguistics and Natural Language Processing, Clanrye International, 2020.

Web references:

1. https://archive.nptel.ac.in/courses/106/105/106105158/
2. https://research.google/research-areas/natural-language-processing/
3. https://www.cse.iitb.ac.in/~cs626-460-2012/
4. https://web.stanford.edu/~jurafsky/slp3/

Program:	B. Tech. (Computer Engineering (Regional Language))	Semester: VII / VIII
Course:	Project Based Learning - V	Code: BCER7521 / BCER8521

Teaching Scheme				Evaluation Scheme			
Practical	**Tutorial**	**Credit**	**Hours**	**TW**	**PR**	**OR**	**Total**
04	-	02	04	50	-	25	75

Course Name		Group A		Group B
	Part I	Business Intelligence	**Part IV**	Computer Vision
	Part II	Advanced Database Systems	**Part V**	Network and Application Security
	Part III	Virtual Reality / Augmented Reality	**Part VI**	Natural Language Processing

Course Objectives:

1. To make students aware about the latest tools of Programme / Professional Elective Course.
2. To develop skills for implementing a project using various technologies.
3. To analyze the result of implemented solutions.

Course Outcomes:

After learning the course, students will be able to:

1. Apply the practical knowledge and latest tools of Professional Elective Course.
2. Design and develop a project using technologies of Professional Elective Course.
3. Interpret the implemented solutions in the team.

Common Guidelines for PBL-V:

Students have to develop a mini project based on Group A (PEC-5) and Group B (PEC-6) courses.

General Guidelines:

- Project group shall consist of not more than 3 students per group.
- Project report should address technical parameter/s analysis, end results and software performance parameters.
- All activities are required to be recorded in the logbook.

The project selection:

- Project Selection should be based on Group A (PEC-5) and Group B (PEC-6) courses to introduce incremental advancements in the existing technology or operations.
- Emphasis should be given in the implementation of software related improvements in the existing system or incremental software advancements in an application/data driven application.

Project Implementation:

- The project with the software enhancement should demonstrate UI/dashboard development, data processing and data handling unit with interfacing to appropriate I/O.

Text Books: Same as listed in PEC – 5 and PEC – 6.
Reference Books: Same as listed in PEC – 5 and PEC – 6.
Web Reference: Same as listed in PEC – 5 and PEC – 6.

Program:	**B. Tech. (Computer Engineering (Regional Language))**			**Semester: VII / VIII**			
Course:	**E- waste management(OEC-5)**			**Code: BCI7605A / BCI8605A**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**FA 1**	**FA 2**	**SA**	**Total**
03	-	03	03	20	20	60	100

Prior knowledge of
Fundamentals of Environmental Engineering, Fundamentals of Sustainable Engineering
is essential.

Course Objectives:

1. To impart knowledge of e-waste in Indian and Global scenarios and role of engineering in e-waste management.
2. To build the concept of the role and responsibility of different stakeholders in the e-waste business.
3. To make aware of e-waste legislation (Acts and guidelines)
4. To get acquainted with recycling and recovering technologies.
5. To create awareness on e-waste global trade.
6. To impart knowledge of the circular economy and e-waste for a sustainable future.

Course Outcomes:

After learning the course, students will be able to:

1. Identify the issues and challenges of e-waste management for a sustainable environment.
2. Explain the role and responsibilities of stakeholders and directory bodies for e-waste control measures.
3. Explain legislation (Acts and guidelines) and apply sustainable approaches.
4. Identify the e-waste handling process, recycling, and recovery techniques for a sustainable future.
5. Explain e-waste global trade and economy.
6. Apply a circular economy road map for an e-waste sustainable future.

Detailed Syllabus

Unit	**Description**	**Duration (H)**
I	**Introduction to Electronic and Electrical Waste (e-Waste)** What is E-Waste, Indian and global scenario of e-Waste, Growth of the Electrical and Electronics industry in India and global, Composition and characteristics of e-waste, e-waste pollutants, Possible hazardous substances present in e-waste, Environmental and Health implications-waste disposal issues and challenges for domestic and commercial, Awareness and approach towards E-waste, Role and responsibility of engineering in e-waste management Case Study.	**07**
II	**Electronic and Electrical Waste (e-Waste) control measures** Need for stringent health safeguards and environmental protection laws in India, Regulatory compliance including roles and responsibilities of different stakeholders, Proposed reduction in the use of hazardous substances(RoHS), Extended Producer's Responsibility (EPR) targets Import of e-waste permissions, Producer-Public-Government cooperation, Administrative Controls & Engineering controls, monitoring of compliance of Rules, Effective regulatory mechanism strengthened by manpower and technical expertise, Reduction of waste at source. Case Study.	**07**

III	**E-waste Legislation** The regulatory regime for e-waste in India, Hazardous and other Wastes (Management & Transboundary Movement) Rules, 2016, e-waste (Management) Amendment Rules, 2018, 2022 .A comprehensive analysis of e-waste legislation worldwide. International Conventions, Regulations and Laws, handling e-waste in developed and developing countries: initiatives, practices, and consequences with a case study. G20 summit 2023.	**07**
IV	**Electronic and Electrical Waste (e-Waste) Management** Basic principles of e-waste management, Technologies for segregation and recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials, occupational and environmental health perspectives of recycling e-waste in India. Reuse of E-waste. Carbon footprint and credits for recycling, Case study on recycling and recovering technology.	**08**
V	**E-waste hazards on Global trade** Essential factors in the global e-waste trade economy, e-waste trading as a quintessential part of electronic recycling, free trade agreements as a means of waste trading. Import of hazardous e-waste in India; India's stand on liberalizing import rules, E-waste economy in the organized and unorganized sector. Estimation and recycling of e-waste in metro cities of India with case study.	**08**
VI	**Circular economy and e-waste** Sustainable management of e-waste and circular economy, Achieving UN Sustainable Development Goals (SDGs) and E-Waste, Urban mining towards sustainable future and circular economy, Entrepreneurship and expertise in e-waste, global challenges and opportunities in structured e-waste management. Circular electronics roadmap, Circular economy startup in India with a case study.	**08**
	Total	**45**

Text Books:

1. Hester R.E., and Harrison R.M, Electronic Waste Management. Science, Latest edition
2. Electronic Waste Management: Edition 2, by G H Eduljee, R M Harrison, Royal Society of Chemistry 2022, ISBN 978-1-78801-744-2
3. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi

Reference Books:

1. Fowler B, Electronic Waste – 1 st Edition (Toxicology and Public Health Issues), 2017 Elsevier

Web References:

1. https://cpcb.nic.in/e-waste/
2. https://courses.iid.org.in/course/e-waste-recycling-business
3. https://www.suritex.co.in/
4. http://greenscape-eco.com/
5. https://onlinecourses.nptel.ac.in/noc20_ce12/preview
6. https://nielit.gov.in/gangtok/content/paid-course-e-waste-management

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Advanced Instrumentation in Infrastructural Engineering(OEC-5)			Code: BCI7605B / BCI8605B			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Prior knowledge of

Fundamentals of Infrastructure engineering, Fundamentals of geotechnical and transportation engineering **is essential.**

Course Objectives:

1. To impart knowledge of advanced instruments used in Road Infrastructure
2. To Identify the advancement in various modes of transportation
3. To make aware of the scope of various instruments in monitoring fields.
4. To get acquainted with sensors and transducers.

Course Outcomes:

After learning the course, students will be able to:

1. Elaborate the role of various agencies involved in building road infrastructure and allied areas
2. Explain different attributes related to urban transportation
3. Analyze the various tools and measures to delineate with the traffic conflicts in an urban city
4. Determine the properties of soils using various advanced instruments.
5. Apply the knowledge of instruments in various monitoring fields.
6. Discover the additional attributes in advanced sensors and their role in Civil Engineering.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Pavement Infrastructure** Introduction to pavement infrastructure, Types of pavement (Flexible, Rigid and Composite), IRC (Indian Roads Congress) and MoRTH (Ministry of Road Transport and Highways) guidelines, Role of National Highway Authority of India in pavement construction, Advanced Instrumentation in Pavement construction, Modern Modes of Transportation (Road, Rail, Air and Water transportation)	07
II	**Urban Public Transportation** Urban growth and public transport needs – Transit mode classifications -Transit characteristics- Demand estimation- Frequency & Fleet size determination, Advanced Survey Instruments Requirements of Pedestrians; Pedestrian facilities on Urban Roads; Cycle Tracks – Guidelines and Design standards; Bus bays – Types and Guide lines; Design of On-street and Off street Parking facilities – Guidelines for lay out Design. Types of Road Markings,Traffic Impact Attenuators, Safety Barriers, Traffic signals: types and principles of phasing	09

III	**Traffic Monitoring and Control** Traffic Studies: Basic characteristics of Traffic, Volume, Speed and Density, Traffic Volume studies, Speed and Delay studies, Accident Studies and road safety auditing, Traffic calming measures and modern traffic control devices	**06**
IV	**Soil properties using advanced instruments** Pore pressure measurement, Earth pressure cell, Settlement gauges. Inclinometers, Stress measurements, Seismic measurements. Advanced instrumentation in Earthquake resistant structures	**07**
V	**Scope of Geotechnical Instruments In Various Monitoring Fields** Dam Monitoring Solutions-Water level, Water pressure and seepage, Lateral ground movement, Deformation, Displacement, Stress, Strain, Load Temperature, Tilt, Surface Settlement. Tunnel Monitoring Solutions- Lateral ground movement, Deformation, Displacement, Stress, Strain, Load ,Temperature Tilt, Surface Settlement. Structural Monitoring Solutions- Tilt Monitoring, Crack Monitoring, Settlement Monitoring, Lateral Ground Movement, Temperature Monitoring, Pore Pressure Monitoring.	**08**
VI	**Sensors & Transducer:** Introduction to digital encoding transducer- digital displacement transducers-shaft encoder-optical encoder, Introduction to Smart Sensors, Overview in Applications of sensors in Infrastructural Engineering.	**08**
	Total	**45**

Text Books:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Highway Engineering, C.E.G.Justo and S.K.Khanna, Nem Chand and Brothers.
3. 3.ChakrobortyP.,DasN.,Principlesof Transportation Engineering(2nd edition),PHI,NewDelhi,2017
4. Handbook of Geotechnical Investigation and Design Tables, Routledge, 2007.
5. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
6. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013

Reference Books:

1. Transportation Engineering - An Introduction - C.JotinKhisty, Prentice Hall Publication
2. Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, D.C., 2010
3. Geotechnical Investigation Methods: A Field Guide for Geotechnical Engineers. EHUNT, Taylor & Francis, .2006.
4. Koerner, R.M. "Designing with Geosynthetics", Prentice Hall, New Jersey, USA, 5th edition, 2005.
5. IRC and MoRTH standards

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII		
Course:	MOOC (OEC-5)			Code: BCER7609 / BCER8609		
Teaching Scheme				Evaluation Scheme		
Lecture	Tutorial	Credit	Hours	FA	Certification Exam	Total
-	-	03	-	70	30	100

Prerequisite: As mentioned in MOOC

Course Objectives:

1. MOOC courses are introduced to imbibe self learning in students.
2. To prepare students for modern tools and techniques.

Course Outcomes:

After learning the course, the students should be able to:

1. Inculcate Self learning.
2. Explore modern tools and techniques.

Guidelines for Students:

1. Individual students need to select MOOC course as OEC-5..
2. Students should select MOOC from the NPTEL online platform only.
3. Selected MOOC course should be of 8 / 12 weeks.
4. Individual students should check that the selected course is not similar to the courses studied in earlier semester.
5. Students must take prior approval from Mentor and MOOC coordinator through the prescribed form given in Annexure-5.
6. Students must submit proof of course registration done in NPTEL along with Annexure-5.
7. Students must complete all assessments related to the selected course as prescribed by the course in NPTEL.
8. After the completion of the course, students shall be required to submit the photocopy of completion certificate showing marks obtained to the department for earning the required credits.

Guidelines for Mentor and MOOC Co-ordinator:

1. Mentor and MOOC Coordinator shall check content of the NPTEL course for applicability/importance/ relevance etc to the student and then recommend the course.
2. Mentor and MOOC Coordinator shall check that selected course is not similar to the courses studied in earlier semester.

Web references:

1. https://onlinecourses.nptel.ac.in

Annexure 5: MOOC Course Approval Form

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Bio-Inspired Systems and Computing (OEC-5)			Code: BET7601 / BET8601			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Prior knowledge of
Data Science and Statistics
is essential.

Course Objectives:

1. To explain bio-inspired theorem and algorithms
2. To demonstrate role of random walk and simulated annealing
3. To discuss genetic algorithm and differential evolution with their applications
4. To elaborate use of swarm optimization and ant colony for feature selection.

Course Outcomes:

After learning the course, students will be able to:

1. Understand bio-inspired algorithms used in computing.
2. Implement optimization using genetic algorithms.
3. Explore role of swam optimization in computing algorithms
4. Apply bio inspired algorithms in image processing applications.
5. Describe bio-inspired routing protocols for VANETs
6. Understand bio-mimetically inspired robot prototype.

Detailed Syllabus

Unit	Description	Duration (H)
I	**INTRODUCTION** Bio-inspired Computing, The influence of brain science on Brain-inspired computing, Development focus of bio-inspired algorithms, Paradigm of evolution of algorithms with increase of complexity of problems. Current Issues in Bio-Inspired Computing	06
II	**GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION** Introduction to genetic algorithms, Components of genetic algorithms, Properties of genetic algorithms, Linear genetic programming, Biological vs. artificial evolution. Applications: Prediction of cancer survival	07
III	**SWARM OPTIMIZATION AND FIREFLY ALGORITHM** Swarm intelligence - PSO algorithm, Properties of PSO, binary PSO, Types of Swarm-Intelligence-Based Algorithms The Firefly algorithm - algorithm analysis - implementation - variants- Ant colony optimization toward feature selection.	08

IV	**APPLICATION IN IMAGE PROCESSING** Bio-Inspired Computation and its Applications in Image Processing: An Overview, Improved Weighted Threshold based Histogram Equalization Algorithm for Digital Image, Contrast Enhancement Using Bat Algorithm, Mobile Object Tracking Using Cuckoo Search	**08**
V	**BIO-INSPIRED ROUTING PROTOCOLS FOR VANETs** Motivations for using bio-inspired approaches in VANET routing, Fundamental concepts and operations of bio-inspired VANET routing, Basic bio-inspired algorithms used in VANET routing literature, Swarm intelligence for VANET routing	**08**
VI	**BIO-MIMETICALLY INSPIRED ROBOT PROTOTYPE** Definition: Bionics, Biomimetics, Bio-inspired, and Biotechnology, State of the Art in Robotics and Robotic Actuation, Biomimetically Inspired Robot Prototype, The Robot's Performance, Field of Application	**08**
	Total	**45**

Text Books:

1. Yang, Cui, XIao, Gandomi, Karamanoglu ,"Swarm Intelligence and Bio-Inspired Computing", Elsevier, First Edition, 2013
2. Xin-She Yang, Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing", Elsevier First edition 2016
3. Abdelhamid Mellouk, Salim Bitam, "Bio-Inspired Routing Protocols for Vehicular Ad Hoc Networks",Wiley , First edition 2014.
4. Ralf Simon King , "BiLBIQ_ A Biologically Inspired Robot with Walking and Rolling Locomotion" Volume 2, [Biosystems &Biorobotics] , Springer Berlin Heidelberg, 2012

Reference Books:

1. Mattias Wahde, "Biologically Inspired Optimization Methods: An Introduction", WIT Press, First edition 2008
2. Eiben, A.E., Smith, James E, "Introduction to Evolutionary Computing", Springer 2015.
3. Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech 2013
4. Acharjya, D. P._ Santhi, V - Bio-Inspired Computing for Image and Video Processing-CRC Press, 2018.
5. Xin-She Yang, "Nature Inspired Optimization Algorithm, Elsevier First Edition 2014

Web References:

1. Arpan Kumar Kar,Bio inspired computing – A review of algorithms and scope of applications, Expert Systems with Applications,Volume 59,2016,Pages 20-32,ISSN 0957-4174, https://doi.org/10.1016/j.eswa.2016.04.018

Program:	**B. Tech. (Computer Engineering (Regional Language))**			**Semester: VII / VIII**			
Course:	**Sensor and Automation with IoT (OEC-5)**			**Code: BET7602 / BET8602**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**FA 1**	**FA 2**	**SA**	**Total**
03	-	03	03	20	20	60	100

Prior knowledge of
Basic Electronics Engineering and Programming with Arduino
is essential.

Course Objectives:

1. Explain fundamental methods and characteristics of measurement systems.
2. Introduction to various types of transducers with working principles
3. Make students aware of need of computer aided process automation in industrial applications.
4. Demonstrate PLC ladder programming for design of basic logic gates for various applications
5. Make students familiar with various applications of IoT.

Course Outcomes:

After learning the course, students will be able to:

1. Illustrate the working principle of various types of transducers and their characteristics.
2. Choose proper sensor comparing different standards, guidelines and requirements for measurements of displacement, velocity, acceleration and level.
3. Select proper sensor comparing different standards, guidelines and requirements for measurements of Temperature and Force
4. Describe the need and concept of process control and automation systems
5. Design of basic logic gates using ladder programming.
6. Explain applications of IoT for real life application in automobile and healthcare.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Sensors and Transducers** Introduction to Sensors, Description and Working principle, Types of sensors, Specifications of Sensors. Introduction to transducers, Advantages and Disadvantages of Electrical Transducers, Classification of Transducers**,** Static and Dynamic characteristics, Difference between sensors and transducers	**07**
II	**Sensors for Displacement, Vibration, Acceleration and Level** Classification of Displacement Sensors: Potentiometer, Strain-gauged element, Capacitive element, Differential transformers, Eddy current proximity sensors, Inductive and Capacitive Proximity switch, Optical encoders. Pneumatic sensors (Bellows, Diaphragm), Hall effect sensors, Accelerometer, Gyroscope and Magnetometer (ADXL335/345), Electro-Optical Sensors, Position Encoders.	**08**

III	**Force and Temperature Sensors** Basic methods and types of force measurement: elastic force, strain gauge, piezoelectric, inductive, Capacitive load cells. Methods of temperature measurement: Optical Fiber, Resistance Temperature Detectors, Thermistor, Thermocouples	**07**
IV	**Computer Aided Process Control and Automation Systems** Introduction of computer aided process control hardware, Industrial communication systems, Introduction of Computer based data acquisition system **(DAQ)**, fundamentals of automation, Automation principles and strategies, reasons for Automating, basic elements of an automated system: Power, Program and control system.	**08**
V	**Introduction of Programmable Logic Controllers** Fundamentals of PLC, PLC selection criteria and applications of PLC Introduction to PLC programming, Ladderdiagram, Sequential flow chart, Industrial bus systems **Case Study**: Basic Logic Gates implementation using Ladder programming, Temperature Measurement with interfacing to DAQ	**08**
VI	**Introduction to Internet of Things** Overview of Internet of Things- the Edge, Cloud and the Application Development, Anatomy of the Thing, Basic Concept of IoT, Sensor Interface in IoT systems, Design Model for IOT Case Study 1: IoT based Automobile Sector (Engine Management System) (Mention of Fuel Level, Ignition, Exhaust Sensors) Case Study 2: IoT based Healthcare Systems (Block Diagram and Simulation)	**07**
	Total	**45**

Text Books:

1. A.K. Sawhney: "A Course in Electrical and Electronic Measurements and Instrumentation", 18th Edition, Dhanpat Rai Publications, 2001
2. D. Patranbis, "Sensor and Transducers", 2nd Edition, PHI publication, 2005.
3. Krishna Kant, "Computer - Based Industrial Control", 2nd Edition, Prentice Hall, New Delhi, 2011
4. Frank D. Petruzella, "Programmable Logic Controllers", 5th Edition, McGraw- Hill, New York, 2016.
5. Joe Biron& Jonathan Follett, Oreilly, "Foundational Elements of an IOT Solution - The Edge, Cloud and Application Development", First Edition, March 2016

Reference Books:

1. Jacob Milman, Christos Halkias, Chetan D. Parikh, "Millman's Integrated Electronics", McGraw Hill Education India Pvt. Ltd., Second edition, 2010
2. Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson New International, 2013.
3. Lukas M.P, "Distributed Control Systems", Van Nostrand Reinhold Co., New York, 1986.
4. N. Viswanandham, Y. Narahari, "Performance Modeling of Automated Manufacturing Systems", 1st Edition, 2009
5. Lucas Darnell, "The Internet of Things (A Look at Real World Use Cases and Concerns)". Kindle Edition, 2016

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Project Management & Governance (OEC-5)			Code: BME7605A / BME8605A			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Prior knowledge of Statistics **is essential.**

Course Objectives:

1. Course is designed to introduce students to the principles and practices of project management as they relate to mechanical engineering projects.
2. Students will learn the skills and knowledge required to successfully plan, execute, and complete projects in the field of mechanical engineering.

Course Outcomes:

After learning the course, students will be able to:

1. Understand the concept of project management
2. Apply the knowledge of project planning to develop project schedules and resources
3. Apply appropriate project management practices, tools, and methodologies.
4. Define, analyze, refine, and document project requirements, assumptions, and constraints
5. Analyze and refine project time and cost estimates to define project baseline, schedule and budget.
6. Understand how to manage project resources, budgets, and timelines.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Project Management** Objectives of Project Management- Importance of Project Management- Types of Projects Project Management Life Cycle- Project Selection – Feasibility study: Types of feasibility Steps in feasibility study, Introduction to project management softwares.	08
II	**Project planning and Implementation** Project Scope- Estimation of Project cost – Cost of Capital – Project Representation and Preliminary Manipulations - Basic Scheduling Concepts - Resource Levelling – Resource Allocation, case studies on PP&I, NPV, IRR, and ROI	08
III	**Project Monitoring and Control** Setting a base line- Project management Information System – Indices to monitor progress. Importance of Contracts in projects- Teamwork in Project Management - Attributes of a good project team – Formation of effective teams – stages of team formation	08

IV	**Project Risk Management** Introduction to project risk management, Key risk management concepts and terminology, Importance of risk management in projects, Risk identification techniques, Qualitative risk assessment, Quantitative risk assessment, Risk response planning, Risk management strategies, Risk monitoring and control, case study on Risk management in engineering projects	**08**
V	**Project Resource Management** Introduction to project resource management, resource management concepts and terminology, identifying project resources, Resource allocation techniques, Resource optimization techniques, Resource leveling, Resource smoothing, Resource scheduling techniques, Project timeline management, Cost estimation techniques, Cost control and monitoring	**07**
VI	**Project Communication** Introduction to Project Communication, Key communication concepts and terminology, Importance of communication in projects, Developing communication plans, Communication channels and methods, Communication Strategies, Communication during project execution, Communication with Stakeholders, Crisis communication strategies	**06**
	Total	**45**

Text Books:

1. Project Management, Harold Kerzner, Wiley Publishing, 2013, 11th Edition, ISBN 9781118022276

Reference Books:

1. Berkun, Scott (2005), The Art of Project Management, O'Reilly Media: Cambridge, MA.
2. Berkun, Scott (2008), Making Things Happen: Mastering Project Management, O'Reilly Media: Cambridge, MA.
3. Karen (2001), Getting Started in Project Management, Wiley: New York

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Industrial Engineering (OEC-5)			Code: BME7605B / BME8605B			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Prior knowledge of
Basics of Engineering
is essential.

Course Objectives:

1. To make students aware of management, its principles, organizations and structure, and Types of production systems.
2. To make students aware of productivity, measures of productivity and its improvement techniques.
3. To make students aware of Human factors at the workplace and Human resource management.
4. To make students aware of financial management in an organization.

Course Outcomes:

After learning the course, students will be able to:

1. Apply principles of management
2. Use various productivity measures and suggest suitable productivity improvement techniques.
3. Calculate economic order quantity and cost associated with inventory decisions.
4. Suggest a suitable plant location and layout.
5. Understand facets of Human resource management.
6. Calculate the break-even point and payback period.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction** Management definition, importance, functions, Taylors scientific management theory, Principles of Management, Organization types and structures.	07
II	**Productivity** Definition, measures and indexes, Productivity improvement techniques, Method Study and Work measurement	07
III	**Inventory** Types of Inventory, Need, Cost associated with inventory, Economic order quantity, Models of Inventory Control, Selective control of Inventories	07

IV	**Plant Location and Layout** Plant Location: Need and factors influencing plant location, Plant Layout: Objectives, principles, types of plant layouts, Introduction to Assembly Line Balancing and Layout parameters to evaluate. Introduction to computer-aided ergonomic analysis of workstation. Assessment of postures and identification of risks to body regions.	**08**
V	**Human factors** Human Error, Accidents, and Safety, Human relation in industry, Introduction to computer-aided ergonomic workstation analysis. Assessment of postures and identification of risks to body regions. Performance appraisal, Human Factors in Systems Design, Human resource management.	**08**
VI	**Costing** Introduction to Marginal Costing: Elements of Cost, Break-Even Analysis. Techniques for Evaluation of capital investments. The pay-back period for investments.	**08**
	Total	**45**

Text Books:

1. M. Telsang, Industrial Engineering and Production Management, S. Chand Publication, 2018
2. O. P. Khanna, Industrial engineering and management, Dhanpat Rai publication, 2018
3. M Mahajan, Industrial Engineering and Production Management, Dhanpat Rai and Co., 2015

Reference Books:

1. Introduction to Work Study by ILO, ISBN 978-81-204-1718-2, Oxford &IBHPublishing Company, New Delhi, Second Indian Adaptation, 2008.
2. H. B. Maynard, K Jell, Maynard_s Industrial Engineering Hand Book, McGraw Hill Education, 2001
3. R. Al-Aomar, A. Williams, O. M. Uigen _Process Simulation using WITNESS ‘, Wiley, 2015
4. Brien Shakel, Applied Ergonomics, Hand Book, Butterworth Scientific, 1988
5. R. C. Bridger, Introduction to Human factor and Ergonomics, McGraw Hill, 2017
6. M. Sanders and E. McCormick, Human Factor Engineering and Design, McGraw Hill, 1992
7. K. Elbert and H. Kroemer, Ergonomics: How to Design for Ease and Efficiency, Prentice Hall, 2018

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII			
Course:	3-D Printing Technique for Construction (OEC-6)			Code: BCI7606A / BCI8606A			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Prior knowledge of
Computer Aided Design & Drafting, Engineering Materials, Strength of Material, Properties of Concrete **is essential.**

Course Objectives:

1. To gain knowledge and skills related to 3D printing technologies.
2. To understand the various software tools, process, material and techniques for construction technology.
3. To apply these techniques into civil Engineering applications like Building, Bridge, wall element, roof ceiling and decorative building elements.

Course Outcomes:

After learning the course, students will be able to:

1. Develop CAD models for 3D printing.
2. Process software files
3. Optimize concrete mix
4. Analyze behavior for strength and challenges in printing
5. Design Mechanism and nozzle
6. Identify defects in post process of printing.

Detailed Syllabus

Unit	Description	Duration (H)
I	**3D Printing (Additive Manufacturing)** Introduction, Process, Classifications, Advantages, Additive v/s Conventional Manufacturing processes, Applications. **CAD for 3D Manufacturing** CAD Data formats, Data translation, Data loss, STL format.	07
II	**3D Techniques** Stereo- Lithography, Laminated Object Manufacturing (LOM), Fused deposition modeling (FDM), Selective laser sintering (SLS), Selective laser melting (SLM), Binder Jet technology. Processing of software file, Process parameter, Process Selection for various applications,	07
III	**Material Properties** Properties of concrete ingredient like cement, sand, fly ash, silica fume, fibers, Concrete Mix proportioning and optimization considering admixtures like super plasticizer, retarders, water reducing agents, quick setting agent etc, viscosity modifying agents, geo-polymers, fibers, alternative material used for printing,	07

IV	**Material Testing & Behavior** Testing on material like compressive strength, bonding strength, workability, setting time, build ability, flow ability, etc, Structural behavior and its Integrity. Challenges like problems of aggregate jamming in the nozzle, compacting obstacles, and the spacing limitations due to rebar and formwork installation.	**08**
V	**Equipment Mechanism** Process Equipment- Design and process parameters, Nozzle design and optimization like shape, diameter, piston type or screw type. Process Design-synchronization of components	**08**
VI	**Post Processing** Requirement and Techniques, Support Removal, Finishing treatment, polishing **Product Quality:** Inspection and testing, Defects and their causes	**08**
	Total	**45**

Text Books:

1. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing by Lan Gibson, David W. Rosen and Brent Stucker, Springer, 2010.
2. 3D Printing and Rapid Prototyping- Principles and Applicationsby CK Chua, Kah Fai Leong, World Scientific, 2017.
3. 3D Printing and Design by Hanser Publisher, Khanna Editorial, Khanna Publishing House, Delhi, 2011.
4. Concrete Technology: Theory and Practice byM. S. Shetty & A K Jain, S. Chand Publication, 2019.

Reference Books:

1. J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.
2. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing".

Web references:

1. 3D Printing and Additive Manufacturing Specialization
   https://www.coursera.org/specializations/3d-printing-additive-manufacturing
2. 3D Printing Software',Jeffrey Smith, Education Manager, Coursera Course by University of Illinois at Urbana-Champaign, USA.
   https://www.coursera.org/specializations/3d-printing-additive-manufacturing
3. 3D Printing Applications',Vishal Sachdev Clinical Assistant Professor , Director, Illinois MakerLab, Coursera Course ,University of Illinois at Urbana-Champaign, USA.
   https://www.coursera.org/learn/3d-printing-applications

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII			
Course:	Structural Health Monitoring & Audit(OEC-6)			Code: BCI7606B / BCI8606B			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Prior knowledge of
Knowledge of Concrete Technology, Knowledge of Rehabilitation and Retrofitting of Structures **is essential.**

Course Objectives:

1. To impart knowledge of diagnosis the distress in the structure, its causes and factors.
2. To assess the health of structure using static field methods and dynamic field methods.
3. To introduce the repairs and rehabilitation measures of the structure.

Course Outcomes:

After learning the course, students will be able to:

1. Understand the deterioration and distress in structures.
2. Evaluate causes and prevention methods for structural health monitoring.
3. Understand Simulation and Loading Methods in static field.
4. Analyze Data Acquisition Systems in dynamic field testing methods.
5. Understand piezo– electric materials and other smart materials in structural health monitoring.
6. Apply the knowledge of NDT techniques on real field.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Structural Health** Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.	07
II	**Structural Health Monitoring & Audit** Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration. Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.	08
III	**Static Field Testing** Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.	08
IV	**Dynamic Field Testing** Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.	08

V	**Introduction to Repairs and Rehabilitations of Structures** Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.	**07**
VI	**NDT (Non Destructive Testing) Techniques** Application of NDT Techniques on real-life problems.	**07**
	Total	**45**

Text Books:

1. Daniel Balageas, Claus_PeterFritzen, Alfredo Güemes, "Structural Health Monitoring", John Wiley and Sons, 2006.
2. Douglas E Adams, "Health Monitoring of Structural Materials and Components_Methods with Applications", John Wiley and Sons, 2000.

Reference Books:

1. J. P. Ou, H. Li and Z. D. Duan, "Structural Health Monitoring and Intelligent Infrastructure", Vol1, Taylor and Francis Group, London, UK, 2006.
2. 2. Victor Giurglutiu, "Structural Health Monitoring with Wafer Active Sensors", Academic Press Inc, 2007.

Web references:

1. https://archive.nptel.ac.in/courses/114/106/114106046/

Program:	**B. Tech. (Computer Engineering (Regional Language))**			**Semester: VII**			
Course:	**Android App Development with Kotlin (OEC-6)**			**Code: BCE7612 / BCE8612**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**FA 1**	**FA 2**	**SA**	**Total**
03	-	03	03	20	20	60	100

Prior knowledge of
Basic programming knowledge (Preferably Java or any other object-oriented language) **is essential.**

Course Objectives:

1. To explore the Kotlin programming language features and scripts.
2. To differentiate between kotlin and java as OOP concepts.
3. To learn the fundamentals of writing Kotlin scripts.
4. To elaborate on the Network and Data Handling Techniques.
5. To learn the advanced Android features.
6. To develop an android application with all features.

Course Outcomes:

After learning the course, students will be able to:

1. Differentiate the data types, variables in kotlin.
2. Explore the object oriented programming concepts with Looping.
3. Demonstrate the android studio development environment.
4. Apply the Network and Data Handling Techniques.
5. Illustrate the Advance Android application development features.
6. Deploy the Android application with testing.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Kotlin and Android Studio** Introduction to Kotlin programming language, Setting up the Android Studio development environment, Kotlin syntax and basic programming concepts, Variables, data types, and operators in Kotlin.	**07**
II	**Kotlin Fundamentals and Object-Oriented Programming with Kotlin** Conditional statements (if, when), Loops (for, while, do-while), Functions, parameters, and return types Kotlin collections: arrays, lists, and maps, Classes and objects, Properties, fields, and methods, Inheritance, polymorphism, and interfaces, Data classes and sealed classes	**08**
III	**Android Basics and User Interface, Components and Navigation** Understanding Android architecture, Activities, intents, and the activity lifecycle, Designing UI with XML and Kotlin, working with views, view groups, and layouts, Fragments and their lifecycle, Navigation and passing data between fragments, RecyclerView and ListView, Android storage options: Shared Preferences, Files, and Databases	**08**

IV	**Networking and Data Handling** Working with RESTful APIs and JSON data, Using Retrofit and OkHttp for network communication, Implementing LiveData and ViewModel, Basic understanding of Coroutines for asynchronous programming	**08**
V	**Advanced Android Features** Notifications and Pending Intent, Location and Google Maps integration, Permissions and runtime permission handling, Material Design components and theming	**07**
VI	**Testing, Debugging, and Deployment** Unit testing and UI testing with JUnit and Espresso, debugging tools and techniques in Android Studio, Optimizing app performance and memory management, Preparing and publishing your app to Google Play Store	**07**
	Total	**45**

Text Books:

1. Programming Android with Kotlin by Pierre-Olivier Laurence, Amanda Hinchman-Dominguez, Mike Dunn, G. Blake Meike, ISBN:9781492063001, Publisher: O'Reilly Media, Inc. (December 2021)
2. Beginning Android Development With Kotlin,Publisher: Greg Lim,2020 ISBN:9811477973, 9789811477973

Reference Books:

1. Android application development with Kotlin by Trivedi Hardik, Publisher: BPB Publications (12 May 2020)
2. Kotlin and Android Development featuring Jetpack: Build Better, Safer Android Apps by Michael Fazio Publisher: Pragmatic Bookshelf (July 2021)

"Knowledge Brings Freedom"

Program:	**B. Tech. (Computer Engineering (Regional Language))**			**Semester: VII / VIII**			
Course:	**Agile Project Management (OEC-6)**			**Code: BCE7613 / BCE8613**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**FA 1**	**FA 2**	**SA**	**Total**
03	-	03	03	20	20	60	100

Prior knowledge of
Software Engineering
is essential.

Course Objectives:

1. Learn to create a framework of Agile Project Management for a project.
2. To understand the Agile project communication and team building.
3. To learn the Agile Retrospectives for planning and monitoring a project.
4. To learn the Agile project analysis and design.
5. To learn how to use the tools that allow taking advantage of an Agile project environment.
6. To get aquatinted with capabilities and knowledge in Agile Project Management.

Course Outcomes:

After learning the course, students will be able to:

1. Explore the framework for agile project communication
2. Elaborate the agile retrospectives for planning and monitoring of agile project
3. Apply the techniques for Agile project estimation.
4. Build the Agile stories for project management
5. Apply the verification and validation for Agile project
6. Adopt Soft skills negotiation practices.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Agile project communications** Introduction, Definition of Agile, Difference between Agile and other methodologies, Agile Principles. Agile Information radiator, Agile Team space, Agile tooling, Osmotic communications for collocated teams, Osmotic communications for distributed teams, Agile Daily stand-ups, Case Study: IT service delivery centre	**07**
II	**Creating High-Performance Team** Build A Team, Define Team Ground Rules, Negotiate Project Agreements, Empower Team Members and Stakeholders, Train Team Members And Stakeholders, Engage And Support Virtual Teams, Build Shared Understanding About A Project, Case Study: Creating High Performance Team Leadership	**08**

III	**Project Planning** Determine Appropriate Project Methodology/Methods And Practices, Plan And Manage Scope, Plan And Manage Budget And Resources, Plan And Manage Schedule, Plan And Manage Quality Of Products And Deliverables, Integrate Project Planning Activities, Plan And Manage Procurement, Establish Project Governance Structure, Plan And Manage Project/Phase Closure, Case Study: Virtual Research Environment Development Project	**07**
IV	**Monitoring and Adopting** Introduction, Agile Retrospectives, Agile task and Kanban boards, Scrum, Agile Timeboxing, Agile Iteration and release planning, Agile WIP limits, Agile Burn down/up charts, Agile cumulative flow diagrams, Agile process tailoring Case Study: Management of a Multidisciplinary Research Project	**07**
V	**Assess and Manage Risks** Assess and Manage Risks, Execute Project To Deliver Business Value, Manage Communications, Engage Stakeholders, Create Project Artifacts, Manage Project Changes, Manage Project Issues, Ensure Knowledge Transfer For Project Continuity, Case Study: Agile Risk Management Process in Multiple Projects Environments	**08**
VI	**Agile analysis and design** Introduction, Agile product roadmap, Agile user stories and backlog, Agile story maps, Agile progressive elaboration, Agile wireframes, Agile chartering, Agile personas, Agile modeling, Agile estimation: Agile relative sizing/story points, Agile wide band Delphi, Agile planning poker, Case Study: project management in a multidisciplinary production environment	**08**
	Total	**45**

Text Books:

1. Layton, Mark C., Steven J. Ostermiller, and Dean J. Kynaston. Agile project management for dummies. John Wiley & Sons, 2020.
2. Mesjasz, Czesław, Katarzyna Bartusik, Tomasz Małkus, and Mariusz Sołtysik. Agile Project Management and Complexity: A Reappraisal. Routledge, 2022.
3. Ajam, Mounir. Project management beyond waterfall and agile. CRC Press, 2018

Reference Books:

1. Adkins, Lyssa. Coaching agile teams: a companion for ScrumMasters, agile coaches, and project managers in transition. Pearson Education India, 2010.
2. Verma, Rahul. "Agile Project Management: Experience and Adoption." In Contemporary Challenges for Agile Project Management, pp. 44-51. IGI Global, 2022.
3. Chatterjee, Sheshadri, Ranjan Chaudhuri, Demetris Vrontis, Alkis Thrassou, and Soumya Kanti Ghosh. "Adoption of artificial intelligence-integrated CRM systems in agile organizations in India." Technological Forecasting and Social Change 168 (2021): 120783.
4. Stellman, Andrew, and Jennifer Greene. Learning agile: Understanding scrum, XP, lean, and kanban. " O'Reilly Media, Inc.", 2014

MOOCs Courses link:

1. https://archive.nptel.ac.in/courses/110/104/110104073/
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/agile-testing-methodology-and-project-management-test-automation/

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Drone Technology (OEC-6)			Code: BET7604 / BET8604			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Prior knowledge of

Basic understanding of physics, sensors and actuators, Control systems and python programming **is essential.**

Course Objectives:

1. To introduce students about the accessories of drone and its functionality.
2. To describe the students about mathematical model of quad copter drone.
3. To make the students, design and development of drone model using Simulink.
4. To discuss the implementation models of different drone based case studies.

Course Outcomes:

After learning the course, students will be able to:

1. Understand the basic concepts of drone technology
2. Justify specifications and requirements of customized drone design.
3. determine different accessories of Drones as per applications.
4. Comprehend drone control system development using Simulink
5. Design Simulink model simulating the complete dynamics of quadcopter drone.
6. Evaluate the design model of existing drone base systems.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to drones** Unmanned Aerial Systems (UAS), Basics of drones, different body materials used for drone, different types of drones, Laws of Motion, Bernoulli's Principle, four forces of Flight, three axes of Flight.	06
II	**Drone accessories I** Sensors & Motors, its types and specifications, design constraints, Test and measurement methods for drone sensors and actuators, Introduction of different types of batteries used in drone. Understand different specifications and their significance of batteries.	07
III	**Drone accessories II** Propellers, Concept of propulsion, Forces working on a Flight, Principle axes and rotation of aerial systems, Role of GPS navigation and telemetry model, interfacing of GPS module to navigation drone.	07

IV	**Drone control system development using Simulink** Control system architecture, Quadcopter with actuator & propellers functionality block, Sensing & estimation functionality block, controller functionality block.	**08**
V	**Modelling, Simulation & Flight control design** Dynamic quad copter system Model, flight control design, 3D visualization, testing &Tuning the model, Flight operations, Applicable software for data collection, processing, and analysis	**09**
VI	**Applications of Drone Technology** Drones in delivering mail, parcels and other cargo, Drones in agriculture, Drones in inspection of transmission lines and power distribution, Drones in disaster management (Flood, Fire etc), Case Study: Eagle Eye drone.	**08**
	Total	**45**

Text Books:

1. John Baichtal ,"Building your own drones, a beginner's guide to drones, UAVS, and ROVs" Pearson Education, 1st Edition,2015
2. Muhammad Usman, "Quadcopter modeling and control with Matlab/Simulink implementation" LAB University of Applied Sciences, 1st Edition, 2020
3. K.S.Fu, R.C.Gonzalez, C.G.Lee, "Robotics control, sensing, vision and intelligence" MGH, 1st Edition, 1987

Reference Books:

1. R.K.Mittal , I.J.Nagrath, "Robotics and control" Tata McGraw-Hill, 1st Edition,2005
2. Ben Rupert , "Drones (The ultimate guide)", Create Space Independent Publishing Platform, 1st Edition,2017
3. Agam Kumar Tyagi, "Matlab and Simulink for engineers", Oxford University Press,1st Edition, 2012

Program:	**B. Tech. (Computer Engineering (Regional Language))**			**Semester: VII / VIII**			
Course:	**Advanced Driver Assistance System (OEC-6)**			**Code: BET7605 / BET8605**			
Teaching Scheme				**Evaluation Scheme**			
Lecture	**Tutorial**	**Credit**	**Hours**	**FA 1**	**FA 2**	**SA**	**Total**
03	-	03	03	20	20	60	100

Prior knowledge of
eVehicle and Automotive Electronics
is essential.

Course Objectives:

1. To introduce Autonomous and Intelligent Vehicle Technology
2. To elaborate ADAS system architecture and features.
3. To explore role of AI in ADAS using various application in autonomous vehicle.

Course Outcomes:

After learning the course, students will be able to:

1. Understand the importance of ADAS in Autonomous and intelligent vehicle
2. Model Sensor technology required in prototype design used in ADAS
3. Apply AI concepts in automated analysis using vision based algorithms
4. Design automated electronics systems for driver assistance.
5. Develop models for safety system in autonomous vehicles.
6. Evaluate the test for maintenance, calibration and diagnostics of ADAS systems.

Detailed Syllabus

Unit	Description	Duration (H)
I	Introduction to ADAS, General Block Diagram, Role of ADAS in Autonomous vehicle, Integration of ADAS Technology into Vehicle Electronics, Non-Passenger Car Advanced Driver Assistance Systems and Autonomous Operation, Intelligent Vehicles	**06**
II	Prototype, Test, Evaluate and Validate ADAS : Generic dynamic and distributed architecture, Environment and climatic conditions , Modeling of perception sensors: Optical Sensor, RADAR, LIDAR, GNSS.	**07**
III	AI for ADAS: The construction of the intelligent vehicle's basic building blocks employing AI methods, Vision sensors, Vision algorithms, Automated Guided Autonomous Car Using Deep Learning and Computer Vision, Deep Learning for Obstacle Avoidance in Autonomous Driving	**08**
IV	Electronics Systems in ADAS, Adaptive Cruise Control (ACC), Rear Cross Traffic Alert (RCTA), Vehicle Exit Alert, Front Cross Traffic Alert, Forward Collision Warning	**08**
V	Safety Systems in ADAS, Blind Spot Detection, Parking Assistance System, Intelligent Head Light Control, Occupant Protection System, Pedestrian Protection System, Evasive Steering Support.	**08**

VI	Calibration of ADAS and Automated Driving Features: Calibration—An Overview Based on Ideality Equation , Common Types of Calibration in an Automated Driving System: End of Line (EoL) Calibration, Service Calibration, Online Calibration, Functional Calibration, Calibration of ADAS and Automated Driving Features , Calibration Environment for Automated Driving Vehicles, Calibration over Diagnostics Interface	**08**
	Total	**45**

Text Books:

1. Abdelaziz Bensrhair (editor), Thierry Bapin (editor) - From AI to Autonomous and Connected Vehicles_ Advanced Driver-Assistance Systems (ADAS)-Wiley-ISTE (2021)
2. Plato Pathrose - ADAS and Automated Driving_ A Practical Approach to Verification and Validation-SAE International (2022)

Reference Books:

1. Harald Waschl, Ilya Kolmanovsky, Frank Willems - Control Strategies for Advanced Driver Assistance Systems and Autonomous Driving Functions-Springer, Vol. 476, 2019.
2. Lentin Joseph (editor), Amit Kumar Mondal (editor) - Autonomous Driving and Advanced Driver-Assistance Systems (ADAS)_ Applications, Development, Legal Issues, and Testing (Chapman &Hall_CRC
3. Yan Li, Hualiang Shi - Advanced Driver Assistance Systems and Autonomous Vehicles_ From Fundamentals to Applications-Springer (2022).

Web References:

1. https://www.udemy.com/course/advanced-driver-assistance-systems/

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII			
Course:	Lean Six Sigma (OEC-6)			Code: BME7606A / BME8606A			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Prior knowledge of
Statistics
is essential.

Course Objectives:

1. Students can apply strategic approaches to eliminate defects within the manufacturing processes.
2. Students will be able to apply the tools and techniques of Lean and six sigma to increase productivity.
3. Students will learn the DMAIC (Define, Measure, Analyze, Improve, Control) methodology, including hands-on exercises and case studies.

Course Outcomes:

After learning the course, students will be able to:

1. Understand the principles and benefits of Lean Six Sigma.
2. Apply statistical tools for defining the quality attributes and measuring the performance of attributes.
3. Apply various tools to identify sources of variation affecting the quality of the process.
4. Apply advanced quantitative techniques to improve processes in manufacturing industries.
5. Understand the Six Sigma Implementation and Challenges in the manufacturing industry.
6. Apply continuous improvement methods to improve the efficiency and effectiveness of the process.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Lean and Six Sigma** Introduction to Lean and quality, Cost of Quality (COQ), the background of quality improvement process, quality characteristics, Introduction to Six Sigma, Principles, and methodologies of lean and six sigma, history and evolution of lean and six sigma, roles and responsibilities of six sigma, benefits of using Six sigma in industries, Introduction to DMAIC approach.	07
II	**Tools used for defining and Measurement of Quality** IPO diagram, Ishikawa diagram, SIPOC diagram, Flow diagram, CTQ tree, Project charter, Histograms, Run Chart, Scatter diagram, Cause and Effect diagram, Pareto chart, Control chart, Flow process chart, Process capability measurement.	08

III	**Tools used for Analysis, Improvement, and Control of quality** Process mapping, Regression analysis, SWOT analysis, TRIZ, PESTLE, 5 why's, interrelationship diagram, overall equipment effectiveness, Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis, Gantt chart, Activity network diagram, Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management.	**08**
IV	**Advanced Quantitative Techniques for Six Sigma** Design for six sigma (DFSS), Failure mode effect analysis (FMEA), Change acceleration process (CAP), Risk priority number (RPN).	**08**
V	**Six Sigma Implementation and Challenges** Lean andSix sigma Implementation cycle, Selection of tools and techniques, Six sigma for startups, Supplier Input Process Output Customer (SIPOC), Quality Function Deployment or House of Quality (QFD), customer quality index (CQI),	**08**
VI	**Continuous Improvement Methods** Introduction to continuous improvement methods, the approach of Poka-Yoke, Kanban, 5's, Lean manufacturing methods: 3M's, 4M's, Kaizen, 5's, case studies on continuous improvement methods.	**06**
	Total	**45**

Reference Books:

1. Michael L.George, David Rownalds, Bill Kastle, What is Lean Six Sigma, McGraw – Hill 2003
2. Thomas Pyzdek, The Six Sigma Handbook, McGraw-Hill,2000
3. Fred Soleimannejed , Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004
4. Forrest W. Breyfogle, III, James M. Cupello, Becki Meadows, Managing Six Sigma:A Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success, John Wiley & Sons, 2000

Web References:

1. https://www.sixsigmacouncil.org/six-sigma-training-material/
2. https://onlinecourses.nptel.ac.in/noc20_mg19/preview

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII			
Course:	Professional Ethics (OEC-6)			Code: BME7606B / BME8606B			
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	FA 1	FA 2	SA	Total
03	-	03	03	20	20	60	100

Course Objectives:

1. To provide students with an understanding of the ethical issues and responsibilities involved in engineering.
2. To create awareness on ethical principles that govern the engineering profession, the potential consequences of unethical behavior, and strategies for making ethical decisions in complex engineering situations.

Course Outcomes:

After learning the course, students will be able to:

1. **Understand** the fundamental ethical principles that govern engineering
2. **Recognize** ethical dilemmas and learn to analyze them,
3. **Develop** critical thinking and decision-making skills for ethical engineering practices
4. **Learn** how to identify and address ethical issues in engineering research and development
5. **Identify and analyse** complex issues and problems in social impact and **develop** appropriate and well-justified solutions for the given context.
6. **Develop** an understanding of the social and global impacts of engineering decisions.

Detailed Syllabus

Unit	Description	Duration (H)
I	**Introduction to Engineering Ethics** Overview of the importance of ethics in engineering, The role of engineers in society, Ethical principles and theories, Case Studies in Practical application of ethical principles and theories.,	08
II	**Ethical Decision Making** Frameworks for ethical decision making, Analysis and discussion of case studies and group discussions/role plays on ethical dilemmas, Identifying stakeholders and ethical responsibilities.	07
III	**Professional Codes of Ethics** Codes of ethics in engineering professions, Understanding the code of ethics and its application in practice, Comparison of different codes of ethics: Selection Criteria, Matrix for the best suited code.	08
IV	**Engineering and Social Responsibility** Social, cultural, and safety, health andenvironmental impacts of engineering, Ethical considerations in engineering design and implementation, Addressing issues of sustainability, circular economyand social justice in engineering.	08

V	**Engineering Research and Development** Ethical considerations in research design, Intellectual property and ownership, Ethical issues in emerging technologies.	**07**
VI	**Engineering and Globalization** The global impact of engineering decisions, Ethical considerations in international engineering projects, Cultural differences and engineering ethics with due consideration to Diversity, Equity and Inclusion	**07**
	Total	**45**

Text Books:

1. Harris, C. E., Pritchard, M. S., &Rabins, M. J. (2019). Engineering ethics: Concepts and cases. 6th Edition, Cengage Learning, Inc..

Reference Books:

1. Mike W. Martin and Roland Schinzinger, (2019). Ethics in Engineering, 3rd Edition, Tata McGraw Hill, New Delhi,
2. Caroline Whitbeck, Ethics in Engineering practice and Research. (2011) 2nd Edition, Cambridge

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII / VIII			
Course:	Major Project			Code: BCER7701 / BCER8701			
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
28	-	14	28	200	150	-	350

Prior knowledge of
Software Engineering, Domain related subjects, Engineering Mathematics
is essential.

Course Objectives:

1. To understand the Project Development Process.
2. To develop problem solving ability by following Software Development Life Cycle meticulously.
3. To review literature for project work from appropriate sources such as books, manuals, research journals and from other sources, and in turn increase analytical skills.
4. To design and implement real world applications using available platforms.
5. To validate and evaluate the work undertaken.
6. To work in a team with individual contribution for the project development
7. To prepare good quality technical reports based on the selected project statement.

Course Outcomes:

After learning the course, the students will be able to:

1. Analyze the literature for various techniques and applications to find the gap and feasible solution.
2. Design real world applications considering emerging areas in technology.
3. Develop an application by considering actual requirements and social, environmental, ethical and legal issues
4. Test and evaluate the model results to develop a probable solution.
5. Work in a team with individual contribution for the project development.
6. Prepare good quality technical reports and present it effectively.

Guidelines:

The intention of Project work is to conceive an idea and to implement it systematically by using knowledge derived during the course of education mainly to innovate or facilitate. A group of Under Graduate students at Final Year will undertake project work. Work involves study of feasibility of the project, planning of project, studying existing systems, tools available to implement the project and state of art software testing procedures and technology with use of case tools, design is to be implemented into a working model (software or hardware or both) with necessary software interface as an executable package.

Projects may be in-house research, sponsored or multidisciplinary. Projects can be carried out inside or outside the institute, in any relevant industry/organization or research institution or labs/organization. The project sponsorship can be of following three categories:

- Self-sponsored project: The expenses incurred towards the completion of the project work will be borne by the students.

- Industry / Research institutes sponsored project: The expenses incurred towards the completion of the project work will be supported by the sponsoring industry or research institute. Students shall submit the sponsorship letter or relevant document mentioning all the necessary details like student's name, guide name, problem definition, work to be carried out, sponsorship details etc.
- Institute sponsored project: The expenses incurred towards the completion of the project work will be supported by any of the institutes or organizations. Students shall submit the sponsorship letter or relevant document mentioning the sponsorship in monetary support from the institutes or organizations. A special review will be carried out in the department for selecting the project group eligible for college sponsorship.

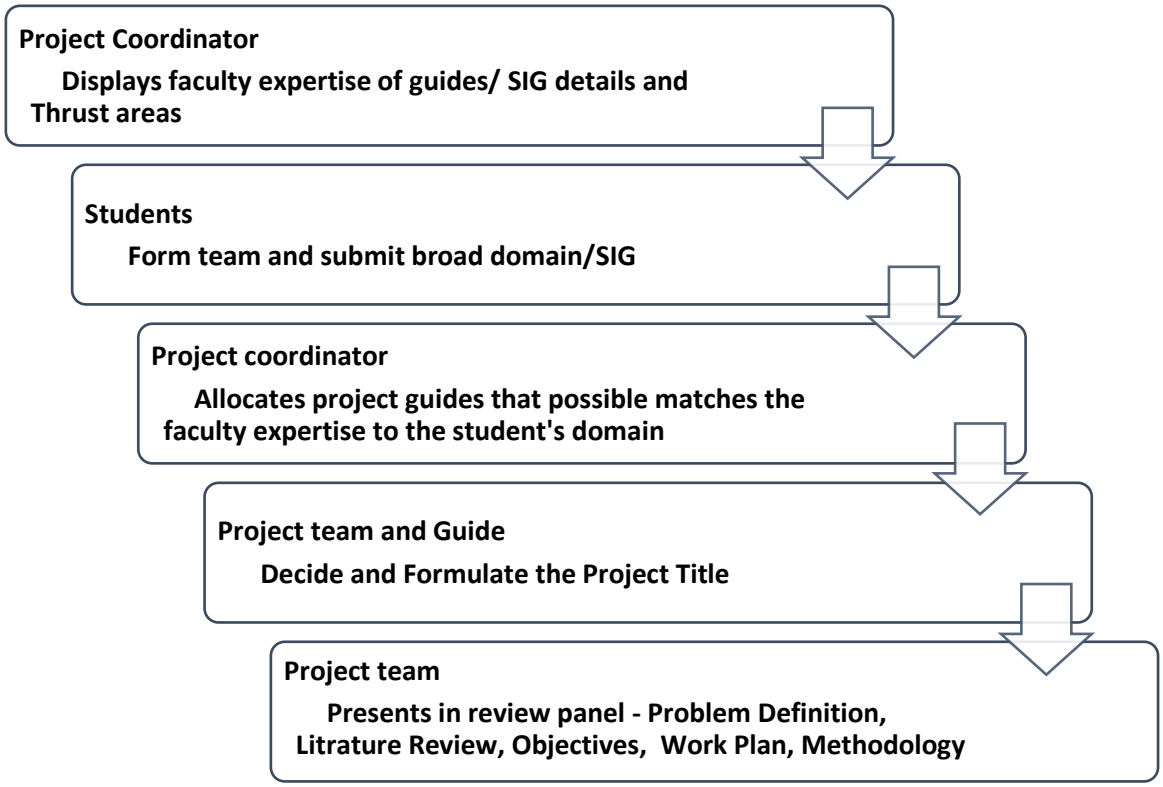
- **Project Team**
- 3 - 4 student**s** can form a team within the same or different discipline and their area of interest is to be registered with the project Coordinator**.**
- It is necessary to explore the domain of interest / research/ thrust area/ society needs.
- Students shall identify the area or topics in recent trends and developments in consultation with institute guide or industry or any research organization.
- Each student of the team has to work collaboratively and contribute significantly for the project development.
- Students shall meet their assigned project guide regularly (at least once in a week) and report the progress of the project work.
- Students shall maintain the record of all the meetings, remarks given by guide / reviewers and progress of the work in the project diary. The project diary must be presented during each review presentation to the reviewers.
- For final examination, students shall complete the project report in all aspects including formatting. Each Student shall prepare the report duly signed by project guide, Head of the department, Director and the external examiner (If applicable). Students should prepare three copies of the project report.
- Students shall submit all the data related to project work in soft copy to their guides which shall include project report, A3 size poster, Presentation, paper etc.
- Students shall write a research article/paper, funding proposal, patent and copyright on their respective project work.

- **Project guide**
- Each project activity must be supervised by a faculty member of the concerned department. This faculty member is termed as a Project Guide.
- In case of an interdisciplinary project, there can be two project guides; one from the parent department and second from the other department.
- Project guide shall help students to finalize (or identify) the project statement and suggest the objectives / methodology through brainstorming. The project team is required to regularly appraise the project guide about the progress and seek his/her guidance.
- Guide will motivate students to select interdisciplinary project / project facilitated and coordinated by Indian Knowledge System (IKS).
- Project guides must monitor the weekly progress being carried out by the project groups.
- In case of industry sponsored projects, guides are expected to visit the industry with students.
- The project guide shall ensure the completion of all the project related activities as per the requirement of review.
- Project guide shall motivate and facilitate the students to write patent, copyright, research funding proposal and paper publications for the overall development of the student.

- **Project Guide Allocation**
- Considering registered teams area of interest/domain and expertise of guide, the project coordinator

in consultation with a panel of experts allots Project guides.

- Guide should be allotted from the same program.
- In case of an interdisciplinary project, along with the guide from same program, guide or co-guide should be allotted from the other program.
- In case of a sponsored project (with reputed industry or any research organization) external guide should be from sponsored company/Industry along with the internal guide from the program.



1. Project Activities

Students are expected to perform the following activities –

i. Review of Recent Literature and Gap Identification
ii. Requirement Analysis and Feasibility Study
iii. Defining the Problem Statement and Objectives
iv. Identifying the Project Implementation Requirements
v. Formulation of Methodology and Mathematical Modeling
vi. Project Implementation
vii. Testing and Deployment
viii. Observations & Results
ix. Results Analysis and Validation
x. Conclusions
xi. Research Paper Publication/IPR Filing if any
xii. Report Writing

2. Project Synopsis

Teams in consultation with guide will prepare project synopsis.The group should submit the synopsis in the following form.

1. Title of Project
2. Names of Students
3. Name of Guide
4. Background
5. Literature Review

6. Problem Definition
7. Objectives
8. Brief Methodology
9. Hardware/Software Requirements
10. References

The synopsis shall be signed by each student in the group, approved by the guide (along with external guide in case of sponsored projects) and endorsed by the Head of the Department.

3. Project Monitoring and Reviews

- The project coordinator with the Head of the department shall constitute a review committee comprising of domain experts and senior faculty members.
- The review committee will approve the project group and title. Discussion/ presentation may be arranged covering topics listed in the synopsis.
- The project guide and review committee will evaluate the timely progress of the projects.
- Students with group members are expected to appear for minimum two reviews as per the project calendar.
- It is mandatory for students to remain present for all the reviews and examinations well before scheduled time.
- Assessment criteria for each review in the form of rubrics should be notified to the students in advance by the project coordinator. Students have to read these carefully and accordingly to be prepared for reviews.
- During reviews, students are required to demonstrate the progress done after the last review.
- The suggestions or corrections given by the review panel committee should be recorded in the project dairy, incorporated and demonstrated in the consecutive reviews.
- Final term work will be calculated based on the performance in reviews.

- **Project Report**

- Report should be prepared using report writing tools such as MS Word, Latex as per the template provided by the department.
- In case of a Sponsored project, students must submit completion certificate with signature of external guide from the sponsored company.
- In case of an Interdisciplinary project, students must submit completion certificate with signature of both the guides.
- Project Report should begin with cover pages (Front Page, Certificate, and Certificate from industry if industry sponsored project, Acknowledgement, Abstract, Table of Contents, List of Figures, and List of tables).
- Then project report should be presented in a number of chapters, starting with Introduction and ending with Summary and Conclusions.
- Each of the other chapters will have a precise title reflecting the contents of the chapter.
- A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.
- Following Chapter should be included in the report-
- **Introduction**- It should be the Chapter 1 and it should highlight the problem posed, define the topic and explain the aim and scope of the work presented in the project report. It may also highlight the significant contributions from the investigation.

a. **Literature Review-** It should be the Chapter 2and this Chapter should present a critical appraisal of the previous work published in the literature pertaining to the topic of the investigation. This chapter highlights the identified research gaps. It is recommended to review the recent literature published in reputed journals/conferences.

b. **Project Design:** It should include Data set design, Architecture diagram/ block diagrams and all

UML diagrams etc.

c. **Chapter on proposed work-** The proposed work should be presented in one or more chapters with appropriate chapter titles**.**
   - Due importance should be given to experimental setups, procedures adopted, techniques developed, methodologies, algorithms developed and adopted.
   - While important derivations/formulae should normally be presented in the text of these chapters.
   - Figures and tables should be presented immediately following their first mention in the text.
   - Equations should form separate lines with appropriate paragraph separation above and below the equation line, with equation numbers flushed to the right.

d. Results and Discussions- This Chapter should include a thorough evaluation of the investigation carried out and bring out the contributions from the study. Quantitative results should be presented in tabular or graphical form. Interpretations of every table and graph should be given in the text. The discussion shall logically lead to inferences and conclusions as well as scope for possible further future work.

e. Summary and Conclusions- This will be the final chapter of the project report. A brief report of the work carried out shall form the first part of the Chapter. Conclusions derived from the logical analysis presented in the Results and Discussions Chapter shall be presented in this chapter. Scope for future work should be stated lucidly in the last part of the chapter.

4. Plagiarism

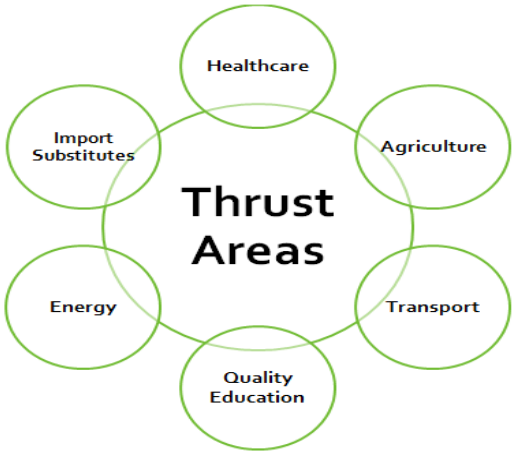
A student has to ensure that the Synopsis, Project Report and Research Publications are checked for plagiarism by using plagiarism software such as Grammerly, iThenticate / Turnitin. The maximum similarity allowed is 10%. The plagiarism verification report must be attached in the project report.

5. Research Outcomes

Based on the project results and conclusions, students are recommended to generate the research outcomes in terms of Research Publication, Patents, and Copyrights. This has to be done in consultation with project guides. Guides will decide the appropriateness of the results and converting those into research outcomes.

"Knowledge Brings Freedom"

6. Thrust Areas for Research



Agriculture and Rural Development

- Mobile App for plant/crop diseases identification and prediction using Machine Learning Techniques.
- Stored grain insect identification: Mobile App for grain sack analysis/scanning for identification of bugs.
- Women friendly improved farm tools for small operations.

- Colour Sorter: Image Processing based affordable grain colour sorting system.
- Micro-climate identification and prediction of local climate of a usually small site or habitat.
- Soil Moisture Monitoring: Wireless system for alerting farmers on the smart phone about how much, when, and where to water their plants or crops.
- Soil nutrients Analyzer Automated Soil micro/ macro-nutrient analyzer
- Food Grain Analysis: Automated system for classification and quality analysis of food grains.
- Cotton picking Automated system for intelligent cotton harvesting machine.
- Seed Sowing Robot Automatic seeding sowing and ploughing machine.
- Automatic weeders for row crops
- Post harvest trash management system (eg. Sugarcane, Maize) (Rural)
- Application for Agro Product & services
- Application for management & Marketing of agro foods & artifacts (rural)
- Replacement to traditional fuel by biodegradable fuel (rural)
- Technique for early detection of pest in cotton
- Perishable crop wastage, storage management
- Application for farming as a service (rural)
- Affordable drone technology for spraying in Indian scenario
- Affordable solution for food processing in Indian Scenario(rural)
- Supply chain management for agro product and services in Indian scenario(rural)
- Telemedicine for rural health care management
- Build an online system for monitoring water quality,leaks, contamination, and managing pipeline networks.
- Smart Garbage systems
- Smart education system
- Development of Low Cost Solar Dryer for Hygienic drying.
- Design and Development of Integrated curing and storage structure for onions.
- Cold Storage Facility for Post-harvest Preservation of Fruits and Vegetables using Solar and Bio methane Heat Based Refrigeration.
- Enhancement of Shelf-life of Perishable Agro Produce using Evaporative Cooling Technology.
- Cost effective mechanism to treat waste water in small villages
- Artificial intelligence enabled robotic trash boat to drive& harvest floating trash from urban drain.
- Priority Road List for Maintenance
- Automatic Assessment of Pavement condition based onroadphotographs

Healthcare Engineering

Medical Imaging	
• Computed tomography (CT) • Diagnostic radiology • Fluoroscopy • Magnetic resonance imaging (MRI)	• Mammography • Medical imaging • Positron emission tomography (PET) • Ultrasound • X-ray
Artificial Organs	
• 3D printing of organs • Artificial organs • Bionics • Bone tissue engineering	• Cartilage tissue engineering • Prostheses • Regenerative medicine • Tissue engineering
Biomaterials	
• Biomaterial surface characterization	• Hydrogel for healthcare

• Biomaterial surface modification • Biomaterials for spine • Breast implants • Cardiovascular materials • Cell therapies • Composite resin fillings • Craniofacial materials • Dental amalgam • Dental materials • Denture adhesives • Dermal fillers • Drug delivery materials • Hydrogel for drug delivery	• Hydrogel for bone • Implant materials • Medical ceramics • Medical metals • Nanotechnology • Ophthalmic materials • Organ therapy • Orthopedic materials • Medical polymers • Protein and cells at interfaces • Stem cells • Tissue engineering
AI based Disease Diagnosis	
Alzheimer's disease/anesthesiology/ arthritis/ asthma/ attention deficit / hyperactivity disorder (ADHD)/ autism/ brain diseases/ cancer/ cardiovascular medicine/ Chronic Fatigue / chronic obstructive pulmonary disease (COPD)/ tuberculosis/ coronary artery disease/ dementia/ dentistry/ diabetes/ diagnosis Ebola/ epilepsy/ flu/ gastroenterology/ healthcare/ heart disease/hematology/ hepatitis/ kidney disease / obesity/ ophthalmology/ orthopaedic/ osteoporosis/ pathology/ precision medicine/ stroke/ women's health/ aging	
Healthcare Systems	
Digital health/E-Health/Electronic health record/Healthcare cybersecurity/Lean healthcare/M-Health/Rural health/Telehealth/Telemedicine	
Internet of Things (IoT) for healthcare	
IoT for patient monitoring/IoT for surgery/Medical IoT data security/Medical IoT device integration/Elderly care/Biomedical Device Manufacturing/Wearable Devices	
Surgery & Robots	
• 3D printing for surgery • Computer-Assisted (Robotic) Surgery • Engineering for neurosurgery • Image-guided surgery • Minimally invasive surgery	• Minimally invasive surgery devices • Robot for heart surgery • Surgical robot • Surgical robot for cardiac surgery

- **Transports and Safety**

• Intelligent Transportation System • Alternate Fuel Based Transportation • Advanced Powertrain Technologies • Affordable Energy Storage And Infrastructure For Fast Charging • Active Aerodynamics • Heat Recovery Systems • Intelligent Roads • Long Life, Low Maintenance Roads And Structures • Self Healing Roads • Fog Vision System For Road And Rail	• Active And Passive Safety Technology • Magnetic Levitation Technology • Tilting Train Technology • Autonomous Vehicles • Novel Modes Of Transport (E.G.Evacuated Tube Transport, Hyperloop) • Amphibian And Flying Vehicles • Biomimetics Design For Ship

Quality Education, Livelihood and Creative Opportunities

• Massively Online Open Courseware (Moocs) • Gaming/ Gamification • Interactive Remotely Controlled Laboratories • Personalised Virtual Teachers • 4g And 5g Communication • Immersive Virtual Reality • Brain Computer Interface And • Machine Augmented Cognition	• Wearable Devices • Digital Identity And Learning Analytics • Automated Evaluation And Assessment Systems • Digital Holography, 3d Imaging And Volumetric/3d Display • 3d Printing • Real Time Translation For Indian Languages

- **Energy**

• Solar PV • Algal Energy • Nuclear Fusion • Fusion Fission Hybrid Reactor • Fast Breeder Reactors For Thorium • Supercritical Coal • Advanced Coal Cycles • Advanced Fossil Fuels Extraction Technologies • Shale Gas • Tight Gas • Gas Hydrate • Hydrogen Energy • Biorefineries	• Hybrid Storage • Fuel Cell • Microbial Fuel Cell • Dc Grids • Smart Grids • Ict Based Smart Monitoring Systems • Wireless Power Transmission • Green And Net Zero Energy Buildings • Smart Windows • Zero Energy Artificial Lighting (E.G. Bioluminescence) • Micro-GasifierCookstove • Brushless Dc (Bldc) Motors

Import Substitutes

Following list 45 items is provided by the Director General of Commercial Intelligence and Statistics (DGCIS), Govt. Of India to encourage the MSME to manufacture indigenously under Atma Nirbhar Bharat Abhiyan

1. Hand presses 2. Inverter Domestic type up to 5 KVA 3. Film Polythene-Including Wide Width Film 4. Toggle Switches 5. Valves metallic 6. Anklets web Khaki 7. Plaster of paris 8. Stoneware jars 9. Centrifugal Pumps and suction and Delivery 10. Air/ Room cooler manufacturing 11. Domestic House wiring with PVC insulated Aluminium 12. Corrugated Paper Board and Boxes 13. Pressure Die Casting up to 0.75kg 14. Rubber cord	24. Cotton Wool (Non-Absorbent) 25. Tent poles 26. Augur (carpenter) 27. Chrome tanned leather 28. Nuts & Bolts or Hand Tools of all Types or Distribution of Board up to 15 amps 29. Office furniture (Wooden chairs/Tables) 30. Pulley wires 31. Paper tapes (Gummed) 32. Insecticides Dust and Sprayers (Manual Only) 33. Street light fittings 34. Windshield wipers (arms and blade only) 35. Transistorized Insulation tester 36. Battery Eliminator, Voltage stabilizer 37. Transformer type welding set confirming

15. Distribution Board upto 15 amps 16. Artistic wooden furniture 17. Squirrel cage Induction Motor 18. Spiked Boots, Skiboots and shoes 19. Steel cross bars, cross arms, clamps, arching horn, brackets 20. Dust Shield leather 21. Domestic electric appliances – Food mixer, wet grinder and food processor 22. M S Tie bars 23. Naphthalene Balls	to IS 1291[1] 38. Hinges, Hasps and staples 39. Garments (excluding supply from Indian Ordnance Factory 40. Hand tools-Mechanical 41. Cane furniture handloom 42. Sluice valves 43. Wooden boards 44. Teak fabricated round blocks 45. Lubricators

Additional Import Substitutes

- Blood Bags - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study, Investment Opportunities, Cost and Revenue, Plant Economics.
- Liquid Organic Fertilizer (Biofertiliser)
- Selenium Coated Aluminium Drum Used In Plain Paper Copier - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study
- Soyabean Cultivation and Processing For Soy Nuggets (Nutrela), Paneer and Milk - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Plant Layout
- Natural Food Colours - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study, Investment Opportunities, Cost and Revenue
- IMFL, INDIAN MADE FOREIGN LIQUOR (WHISKEY, RUM, GIN, VODKA AND BRANDY) - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study
- SANITARY NAPKINS - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study, Investment Opportunities, Cost and Revenue, Plant Layout
- PHOTOCOPIER CLEANING WEB (Non Woven) - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study, Investment Opportunities

- MEDICAL DISPOSABLES: Disposable Syringes (Self Destructive) with Needles, Catheters and Mask - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials

7. Technology Domains

Computer Engineering (Regional Language)	
1.	Data Science and Artificial Intelligence
2.	Block chain Technology
3.	Image Processing, Pattern Recognition and Computer Vision
4.	Natural Language Processing
5.	Cloud Computing/Edge Computing/Fog Computing
6.	Virtual Reality/Augmented Reality

7.	Gaming/Multimedia/Animation/ Computer Graphics
8.	Computational Biology
9.	Wireless Sensor Networks
10.	Machine Learning & Deep Learning
11.	Multi core Computing
12.	Quantum Computing
13.	Green Computing
14.	Human Computer Interaction
15.	ICT and E-learning
16.	Cybernetics, Virtualization and Parallel Computing
17.	Cryptography, Network Security and Cognitive networks
18.	Cognitive Learning
19.	Big Data Analytics
20.	Bioinformatics
21.	Soft Computing
22.	IOT & Sensor data mining
23.	High Performance Computing & Parallelization
24.	Robotic and Automation

List of Annexure:

1. Tentative Activity Calendar of Major Project
2. Rubric Table Review I Assessment of Major Project
3. Rubric Table for Review II Assessment of Major Project
4. Rubric Table for Oral Exam of Major Project

	Pimpri Chinchwad Education Trust's **Pimpri Chinchwad College of Engineering**	
Interdisciplinary B. Tech. Project Guidelines		

Introduction:

This document provides guidelines to the B. Tech. students in carrying out their Final Year project work in an interdisciplinary domain of their interests across departments. The B. Tech. Project (BTP) can be carried out by students from different departments coming together. The BTP is a partial requirement of the award of the degree of Bachelor of Technology (B. Tech.) in respective Engineering departments. The guidelines mentioned herewith ensure the effective execution and the uniformity in the conduction and representation of the project work in all departments. A BTP can be started in the seventh or eighth semester. However, in case of academic gap due to semester leave, the student will be allowed to continue the BTP with the consent of the project guide and the project coordinators.

The BTP is broadly classified as experimental, numerical simulation or product development. An institute level committee chaired by the Dean Academics and three or four members recommended by the Director (preferably Dean R&D, SIG Coordinator, and few senior faculty members) should form the framework for the Interdisciplinary projects across the departments. This committee will be responsible for providing the guidelines for smooth execution of the Interdisciplinary projects and handling the grievances if any.

It is recommended to form the Interdisciplinary Project Assessment Committee (IPAC) to ensure uniformity in project activities, dissertation reports and to coordinate all interdisciplinary project groups across the departments. This committee will be responsible for monitoring, assessment and evaluating the timely progress of the projects and communicating the progress report to the students. The IPAC committee
will be comprised of few senior faculty members from all the departments and the committee will be chaired by a senior professor nominated by the Director, the Dean Academics and the Head of the Departments.

Roles & Responsibilities of IPAC:

1. The IPAC shall invite the interdisciplinary project ideas from the faculty members of all the departments and students.
2. IPAC should display the list of the interdisciplinary project ideas and the faculty members to all the departments and students in the mid of sixth semester.
3. The IPAC shall invite the interest of the students for the projects.
4. Interested students can be forwarded to the respective guides or the students can approach the guide directly.
5. The IPAC will display the final project groups along with the project title, the guide's name and name of the students. The details shall be communicated to all the relevant/respective stakeholders.
6. IPAC will be responsible for smooth and uniform conduction of the reviews of BTPs.
7. The detailed review schedule shall be communicated to the students 07 days in advance.
8. The review panel should be formed for each project group to evaluate the progress of the interdisciplinary project. The IPAC shall monitor the progress of project work on a continuous basis by scheduling and conducting the interdisciplinary project review presentations. The IPAC should provide the evaluation sheet to the review panels based on suitable rubrics for each project review to ensure the quality of the projects.

9. The project reviews shall be conducted as per the schedule. The assessment and evaluation of each student shall be carried out based on their individual participation, knowledge, content and skills. For each review the panel members shall recommend the suitable suggestions. For subsequent reviews, the recommendations should be implemented and can be verified by the review panel. After each review, the panel shall submit the evaluation sheet to the project coordinators.
10. During this process, if any of the project group is not performing satisfactorily, the IPAC shall provide counseling or guidance to improve their performance.
11. The IPAC shall submit names of one external examiner for conducting the final examination.

Roles & responsibilities of the Project Guide:

1. The project guide shall send the proposed project ideas or the detailed information of the proposed project to be offered to the B. Tech.
2. The possible problem statements for project can be availed from
    - **a.** Industries
    - **b.** Research labs or organization
    - **c.** In-house research projects
    - **d.** Collegiate clubs
3. Project guide shall also recommend the name of the departments of the students to be involved in the project execution.
4. The guide should be in touch with the IPAC (or the departments) for suitable students for the project.
5. Project guide shall help students to finalize (or identify) the project definition/statement and suggest the objectives / methodology through brainstorming.
6. Project guides must monitor the weekly progress being carried out by the project groups. In case it is found that progress is unsatisfactory it should be reported to the IPAC for necessary action.
7. In case of industry sponsored projects, guides are expected to visit the industry on a regular basis along with students.
8. The project guide shall ensure the completion of all the project related activities as per the requirement of review.
9. Project guide shall motivate the students to write patent, copyright, research funding proposal and paper publications for the overall development of the student.

Guidelines for Students:

1. It is mandatory for all students to undergo the project work as a part of their final year of the B.Tech. Program.
2. It is the responsibility of the students to complete their project work in the given time frame.
3. The Project group shall have minimum 2 students and maximum 4 students from any division.
4. Project work shall be based on any of the following:

a. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.

b. Experimental verification of principles used in respective engineering applications.

c. Projects having valid databases, data flow, algorithm, and output reports preferably software based.

5. Students shall start working on the selection of problem statements for the project at the end of VI semester.

6. Following are the recommended areas in which students can select the project topics from:

   a. Robotics & Automation

   b. Composites

   c. Artificial Intelligence Based Solutions to Automobile and Manufacturing

   d. Biomedical Device Development and Biomechanics

   e. Renewable & Sustainable Energy

   f. Precision Agriculture

   g. Precision Medicines

   h. Autonomous Driving

   i. Smart Spaces including Smart Home, Smart City, etc.

   j. Drone and UAV Device Development

   k. IOT and Sensor Based Technology

   l. Geospatial and Satellite Technology

7. Each group will be assigned a faculty mentor as Project Guide for necessary guidance and monitoring the project work.

8. Students shall meet their assigned project guide regularly (at least once in a week) and report the progress of the project work.

9. Students shall maintain the record of all the meetings, remarks given by IPAC and progress of the work in the project diary. The project diary must be presented during each review presentation to the DPAC.

10. The project sponsorship can be of following three categories:

    a. Self-sponsored project: The expenses incurred towards the completion of the project work will be borne by the students.

    b. Industry / Research institutes sponsored project: The expenses incurred towards the completion of the project work will be supported by the sponsoring industry or research institute. Students shall submit the sponsorship letter or relevant document mentioning all the necessary details like student's name, guide name, problem definition, work to be carried out, sponsorship details etc.

    c. Institute sponsored project: The expenses incurred towards the completion of the project

work will be supported by any of the institutes or organizations. Students shall submit the sponsorship letter or relevant document mentioning the sponsorship in monetary support from the institutes or organizations. A special review will be carried out in the department for selecting the project group eligible for college sponsorship.

11. Following types of work will not be considered as project work:
    - **a.** Projects based on only Surveying
    - **b.** Projects based on only Case study
    - **c.** Computer simulation-based projects without validation of output
    - **d.** Only Jigs & Fixture manufacturing
    - **e.** Assembly of ready-made components
    - **f.** Only Mobile App development.
12. The project work assessment will be done in following stages:
    - **a.** Review 1: Starting of the semester (within 15 Days) [Presentation & synopsis]
    - **b.** Review 2: After 1 month of review 1 [Presentation]
    - **c.** Review 3: After 1 month of review 2 [Presentation and Report]
    - **d.** Final Examination: At the end of semester
13. Expected work to be completed in the review:
    - **a.** Review 1: Problem definition identification and feasibility
    - **b.** Review 2: Design and Analysis of the work
    - **c.** Review 3: Implementation, Testing and Report Writing
14. It is mandatory for students to remain present for all the reviews and examinations well before schedule time.
15. For final examination, students shall complete the project report in all aspects including formatting. Each Student shall prepare the report duly signed by project guide, Head of the department, Director and the external examiner. Students should prepare three copies of the dissertation report.
16. Students shall submit all the data related to project work in soft copy to their guides which shall include project report, A3 size poster, Presentation, etc.
17. Students shall write a research article/paper, funding proposal, patent and copyright on their respective project work.

Program:	B. Tech. (Computer Engineering (Regional Language))			Semester: VII			
Course:	Major Project Stage 1			Code: BCER7702			
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
14	-	07	14	100	50	-	150

Prior knowledge of
Software Engineering, Domain related subjects, Engineering Mathematics
is essential.

Course Objectives:

1. To understand the Project Development Process.
2. To develop problem solving ability by following Software Development Life Cycle meticulously.
3. To review literature for project work from appropriate sources such as books, manuals, research journals and from other sources, and in turn increase analytical skills.
4. To design and implement real world applications using available platforms.
5. To validate and evaluate the work undertaken.
6. To work in a team with individual contribution for the project development
7. To prepare good quality technical reports based on the selected project statement.

Course Outcomes:

After learning the course, the students will be able to:

1. Analyze the literature for various techniques and applications to find the gap and feasible solution.
2. Design real world applications considering emerging areas in technology.
3. Develop an application by considering actual requirements and social, environmental, ethical and legal issues
4. Test and evaluate the model results to develop a probable solution.
5. Work in a team with individual contribution for the project development.
6. Prepare good quality technical reports and present it effectively.

Guidelines:

The intention of Project work is to conceive an idea and to implement it systematically by using knowledge derived during the course of education mainly to innovate or facilitate. A group of Under Graduate students at Final Year will undertake project work. Work involves study of feasibility of the project, planning of project, studying existing systems, tools available to implement the project and state of art software testing procedures and technology with use of case tools, design is to be implemented into a working model (software or hardware or both) with necessary software interface as an executable package.

Projects may be in-house research, sponsored or multidisciplinary. Projects can be carried out inside or outside the institute, in any relevant industry/organization or research institution or labs/organization. The project sponsorship can be of following three categories:

- Self-sponsored project: The expenses incurred towards the completion of the project work will be borne by the students.

- Industry / Research institutes sponsored project: The expenses incurred towards the completion of the project work will be supported by the sponsoring industry or research institute. Students shall submit the sponsorship letter or relevant document mentioning all the necessary details like student's name, guide name, problem definition, work to be carried out, sponsorship details etc.
- Institutesponsored project: The expenses incurred towards the completion of the project work will be supported by any of the institutes or organizations. Students shall submit the sponsorship letter or relevant document mentioning the sponsorship in monetary support from the institutes or organizations. A special review will be carried out in the department for selecting the project group eligible for college sponsorship.

1. Project Team

- 3 - 4 student**s** can form a team within the same or different discipline and their area of interest is to be registered with the project Coordinator**.**
- It is necessary to explore the domain of interest / research/ thrust area/ society needs.
- Students shall identify the area or topics in recent trends and developments in consultation with institute guide or industry or any research organization.
- Each student of the team has to work collaboratively and contribute significantly for the project development.
- Students shall meet their assigned project guide regularly (at least once in a week) and report the progress of the project work.
- Students shall maintain the record of all the meetings, remarks given by guide / reviewers and progress of the work in the project diary. The project diary must be presented during each review presentation to the reviewers.
- For final examination, students shall complete the project report in all aspects including formatting. Each Student shall prepare the report duly signed by project guide, Head of the department, Director and the external examiner (If applicable). Students should prepare three copies of the project report.
- Students shall submit all the data related to project work in soft copy to their guides which shall include project report, A3 size poster, Presentation, paper etc.
- Students shall write a research article/paper, funding proposal, patent and copyright on their respective project work.

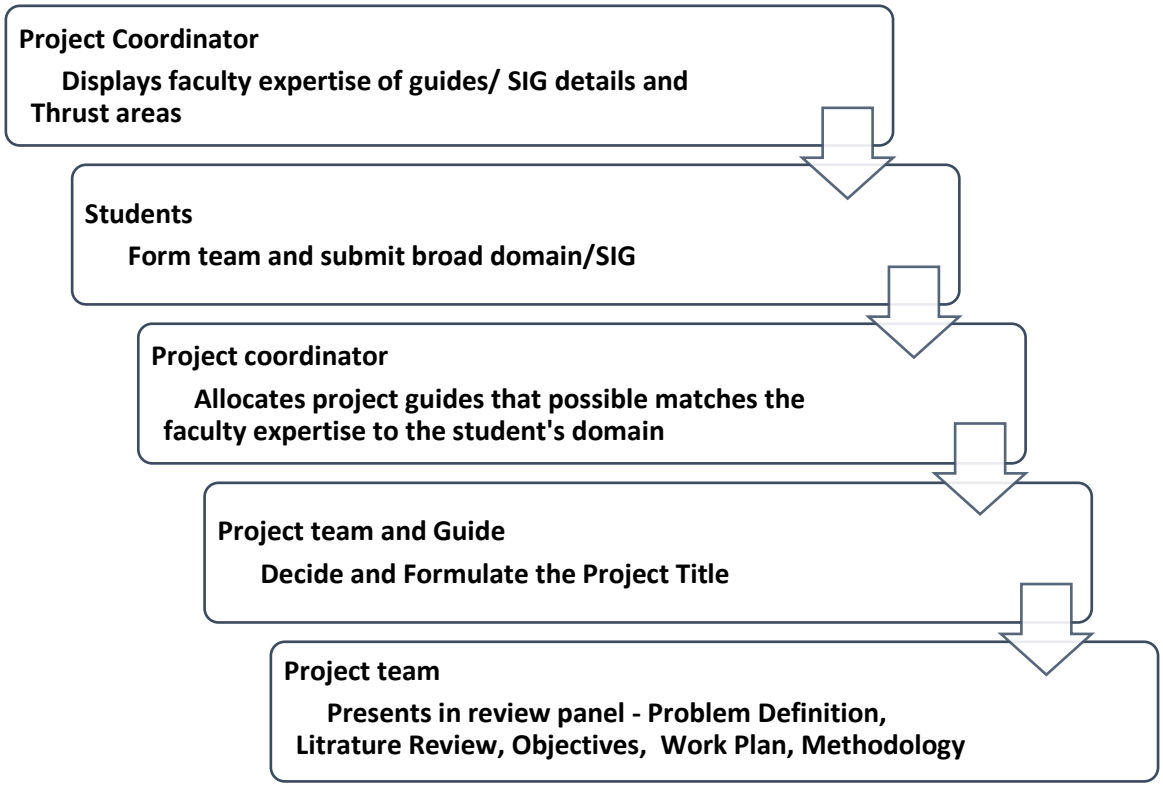
2. Project guide

- Each project activity must be supervised by a faculty member of the concerned department. This faculty member is termed as a Project Guide.
- In case of an interdisciplinary project, there can be two project guides; one from the parent department and second from the other department.
- Project guide shall help students to finalize (or identify) the project statement and suggest the objectives / methodology through brainstorming. The project team is required to regularly appraise the project guide about the progress and seek his/her guidance.
- Guide will motivate students to select interdisciplinary project / project facilitated and coordinated by Indian Knowledge System (IKS).
- Project guides must monitor the weekly progress being carried out by the project groups.
- In case of industry sponsored projects, guides are expected to visit the industry with students.
- The project guide shall ensure the completion of all the project related activities as per the requirement of review.
- Project guide shall motivate and facilitate the students to write patent, copyright, research funding proposal and paper publications for the overall development of the student.

- **Project Guide Allocation**
- Considering registered teams area of interest/domain and expertise of guide, the project coordinator

in consultation with a **panel of experts** allots Project guides.

- Guide should be allotted from the **same program**.
- **In case of an interdisciplinary project**, along with the guide from same program, guide or co-guide should be allotted from the other program.
- **In case of a sponsored project** (with reputed industry or any research organization) external guide should be from sponsored company/Industry along with the internal guide from the program.



3. Project Activities

Students are expected to perform the following activities **Semester I and II** –

xiii. Review of Recent Literature and Gap Identification
xiv. Requirement Analysis and Feasibility Study
xv. Defining the Problem Statement and Objectives
xvi. Identifying the Project Implementation Requirements
xvii. Formulation of Methodology and Mathematical Modeling
xviii. Project Implementation
xix. Testing and Deployment
xx. Observations & Results
xxi. Results Analysis and Validation
xxii. Conclusions
xxiii. Research Paper Publication/IPR Filing if any
xxiv. Report Writing

4. Project Synopsis

Teams in consultation with guide will prepare project synopsis.The group should submit the synopsis in the following form.

11. Title of Project
12. Names of Students
13. Name of Guide
14. Background
15. Literature Review

16. Problem Definition
17. Objectives
18. Brief Methodology
19. Hardware/Software Requirements
20. References

The synopsis shall be signed by each student in the group, approved by the guide (along with external guide in case of sponsored projects) and endorsed by the Head of the Department.

5. Project Monitoring and Reviews

- The project coordinator with the Head of the department shall constitute a review committee comprising of domain experts and senior faculty members.
- The review committee will approve the project group and title. Discussion/ presentation may be arranged covering topics listed in the synopsis.
- The project guide and review committee will evaluate the timely progress of the projects.
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- During reviews, students are required to demonstrate the progress done after the last review.
- The suggestions or corrections given by the review panel committee should be recorded in the project dairy, incorporated and demonstrated in the consecutive reviews.
- Final term work will be calculated based on the performance in reviews.

- **Project Report**

- Report should be prepared using report writing tools such as MS Word, Latex as per the template provided by the department.
- In case of a Sponsored project, students must submit completion certificate with signature of external guide from the sponsored company.
- In case of an Interdisciplinary project, students must submit completion certificate with signature of both the guides.
- Project Report should begin with cover pages (Front Page, Certificate, and Certificate from industry if industry sponsored project, Acknowledgement, Abstract, Table of Contents, List of Figures, and List of tables).
- Then project report should be presented in a number of chapters, starting with Introduction and ending with Summary and Conclusions.
- Each of the other chapters will have a precise title reflecting the contents of the chapter.
- A chapter can be subdivided into sections, subsections and sub subsection so as to present the content discretely and with due emphasis.
- Following Chapter should be included in the report-

f. **Introduction-** It should be the Chapter 1 and it should highlight the problem posed, define the topic and explain the aim and scope of the work presented in the project report. It may also highlight the significant contributions from the investigation.

g. **Literature Review-** It should be the Chapter 2and this Chapter should present a critical appraisal of the previous work published in the literature pertaining to the topic of the investigation. This chapter highlights the identified research gaps. It is recommended to review the recent literature published in reputed journals/conferences.

h. **Project Design:** It should include Data set design, Architecture diagram/ block diagrams and all

UML diagrams etc.

i. **Chapter on proposed work-** The proposed work should be presented in one or more chapters with appropriate chapter titles**.**
   - Due importance should be given to experimental setups, procedures adopted, techniques developed, methodologies, algorithms developed and adopted.
   - While important derivations/formulae should normally be presented in the text of these chapters.
   - Figures and tables should be presented immediately following their first mention in the text.
   - Equations should form separate lines with appropriate paragraph separation above and below the equation line, with equation numbers flushed to the right.

j. Results and Discussions- This Chapter should include a thorough evaluation of the investigation carried out and bring out the contributions from the study. Quantitative results should be presented in tabular or graphical form. Interpretations of every table and graph should be given in the text. The discussion shall logically lead to inferences and conclusions as well as scope for possible further future work.

k. Summary and Conclusions- This will be the final chapter of the project report. A brief report of the work carried out shall form the first part of the Chapter. Conclusions derived from the logical analysis presented in the Results and Discussions Chapter shall be presented in this chapter. Scope for future work should be stated lucidly in the last part of the chapter.

6. Plagiarism

A student has to ensure that the Synopsis, Project Report and Research Publications are checked for plagiarism by using plagiarism software such as Grammerly, iThenticate / Turnitin. The maximum similarity allowed is 10%. The plagiarism verification report must be attached in the project report.

7. Research Outcomes

Based on the project results and conclusions, students are recommended to generate the research outcomes in terms of Research Publication, Patents, and Copyrights. This has to be done in consultation with project guides. Guides will decide the appropriateness of the results and converting those into research outcomes.

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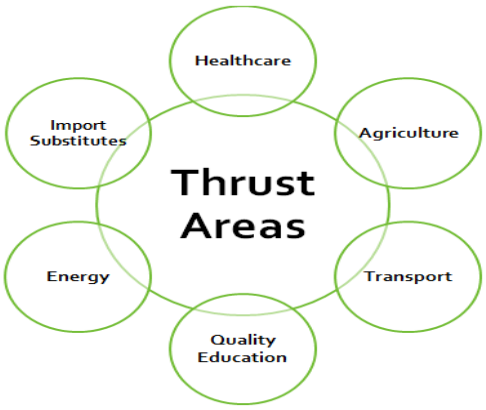
8. Thrust Areas for Research



Agriculture and Rural Development

- Mobile App for plant/crop diseases identification and prediction using Machine Learning Techniques.
- Stored grain insect identification: Mobile App for grain sack analysis/scanning for identification of bugs.
- Women friendly improved farm tools for small operations.
- Colour Sorter: Image Processing based affordable grain colour sorting system.

- Micro-climate identification and prediction of local climate of a usually small site or habitat.
- Soil Moisture Monitoring: Wireless system for alerting farmers on the smart phone about how much, when, and where to water their plants or crops.
- Soil nutrients Analyzer Automated Soil micro/ macro-nutrient analyzer
- Food Grain Analysis: Automated system for classification and quality analysis of food grains.
- Cotton picking Automated system for intelligent cotton harvesting machine.
- Seed Sowing Robot Automatic seeding sowing and ploughing machine.
- Automatic weeders for row crops
- Post harvest trash management system (eg. Sugarcane, Maize) (Rural)
- Application for Agro Product & services
- Application for management & Marketing of agro foods & artifacts (rural)
- Replacement to traditional fuel by biodegradable fuel (rural)
- Technique for early detection of pest in cotton
- Perishable crop wastage, storage management
- Application for farming as a service (rural)
- Affordable drone technology for spraying in Indian scenario
- Affordable solution for food processing in Indian Scenario(rural)
- Supply chain management for agro product and services in Indian scenario(rural)
- Telemedicine for rural health care management
- Build an online system for monitoring water quality,leaks, contamination, and managing pipeline networks.
- Smart Garbage systems
- Smart education system
- Development of Low Cost Solar Dryer for Hygienic drying.
- Design and Development of Integrated curing and storage structure for onions.
- Cold Storage Facility for Post-harvest Preservation of Fruits and Vegetables using Solar and Bio methane Heat Based Refrigeration.
- Enhancement of Shelf-life of Perishable Agro Produce using Evaporative Cooling Technology.
- Cost effective mechanism to treat waste water in small villages
- Artificial intelligence enabled robotic trash boat to drive& harvest floating trash from urban drain.
- Priority Road List for Maintenance
- Automatic Assessment of Pavement condition based onroadphotographs

- **Healthcare Engineering**

• **Medical Imaging**	
• Computed tomography (CT) • Diagnostic radiology • Fluoroscopy • Magnetic resonance imaging (MRI)	• Mammography • Medical imaging • Positron emission tomography (PET) • Ultrasound • X-ray
• **Artificial Organs**	
• 3D printing of organs • Artificial organs • Bionics • Bone tissue engineering	• Cartilage tissue engineering • Prostheses • Regenerative medicine • Tissue engineering
• **Biomaterials**	
• Biomaterial surface characterization	• Hydrogel for healthcare

• Biomaterial surface modification • Biomaterials for spine • Breast implants • Cardiovascular materials • Cell therapies • Composite resin fillings • Craniofacial materials • Dental amalgam • Dental materials • Denture adhesives • Dermal fillers • Drug delivery materials • Hydrogel for drug delivery	• Hydrogel for bone • Implant materials • Medical ceramics • Medical metals • Nanotechnology • Ophthalmic materials • Organ therapy • Orthopedic materials • Medical polymers • Protein and cells at interfaces • Stem cells • Tissue engineering
• AI based Disease Diagnosis	
• Alzheimer's disease/anesthesiology/ arthritis/ asthma/ attention deficit / hyperactivity disorder (ADHD)/ autism/ brain diseases/ cancer/ cardiovascular medicine/ Chronic Fatigue / chronic obstructive pulmonary disease (COPD)/ tuberculosis/ coronary artery disease/ dementia/ dentistry/ diabetes/ diagnosis Ebola/ epilepsy/ flu/ gastroenterology/ healthcare/ heart disease/hematology/ hepatitis/ kidney disease / obesity/ ophthalmology/ orthopaedic/ osteoporosis/ pathology/ precision medicine/ stroke/ women's health/ aging	
• Healthcare Systems	
• Digital health/E-Health/Electronic health record/Healthcare cybersecurity/Lean healthcare/M-Health/Rural health/Telehealth/Telemedicine	
• Internet of Things (IoT) for healthcare	
• IoT for patient monitoring/IoT for surgery/Medical IoT data security/Medical IoT device integration/Elderly care/Biomedical Device Manufacturing/Wearable Devices	
• Surgery & Robots	
• 3D printing for surgery • Computer-Assisted (Robotic) Surgery • Engineering for neurosurgery • Image-guided surgery • Minimally invasive surgery	• Minimally invasive surgery devices • Robot for heart surgery • Surgical robot • Surgical robot for cardiac surgery

• Transports and Safety

• Intelligent Transportation System • Alternate Fuel Based Transportation • Advanced Powertrain Technologies • Affordable Energy Storage And Infrastructure For Fast Charging • Active Aerodynamics • Heat Recovery Systems • Intelligent Roads • Long Life, Low Maintenance Roads And Structures • Self Healing Roads • Fog Vision System For Road And Rail	• Active And Passive Safety Technology • Magnetic Levitation Technology • Tilting Train Technology • Autonomous Vehicles • Novel Modes Of Transport (E.G.Evacuated Tube Transport, Hyperloop) • Amphibian And Flying Vehicles • Biomimetics Design For Ship

• Quality Education, Livelihood and Creative Opportunities

• Massively Online Open Courseware (Moocs) • Gaming/ Gamification • Interactive Remotely Controlled Laboratories • Personalised Virtual Teachers • 4g And 5g Communication • Immersive Virtual Reality • Brain Computer Interface And • Machine Augmented Cognition	• Wearable Devices • Digital Identity And Learning Analytics • Automated Evaluation And Assessment Systems • Digital Holography, 3d Imaging And Volumetric/3d Display • 3d Printing • Real Time Translation For Indian Languages

- **Energy**

• Solar PV • Algal Energy • Nuclear Fusion • Fusion Fission Hybrid Reactor • Fast Breeder Reactors For Thorium • Supercritical Coal • Advanced Coal Cycles • Advanced Fossil Fuels Extraction Technologies • Shale Gas • Tight Gas • Gas Hydrate • Hydrogen Energy • Biorefineries	• Hybrid Storage • Fuel Cell • Microbial Fuel Cell • Dc Grids • Smart Grids • Ict Based Smart Monitoring Systems • Wireless Power Transmission • Green And Net Zero Energy Buildings • Smart Windows • Zero Energy Artificial Lighting (E.G. Bioluminescence) • Micro-GasifierCookstove • Brushless Dc (Bldc) Motors

- **Import Substitutes**

Following list 45 items is provided by the Director General of Commercial Intelligence and Statistics (DGCIS), Govt. Of India to encourage the MSME to manufacture indigenously under Atma Nirbhar Bharat Abhiyan

25. Hand presses 26. Inverter Domestic type up to 5 KVA 27. Film Polythene-Including Wide Width Film 28. Toggle Switches 29. Valves metallic 30. Anklets web Khaki 31. Plaster of paris 32. Stoneware jars 33. Centrifugal Pumps and suction and Delivery 34. Air/ Room cooler manufacturing 35. Domestic House wiring with PVC insulated Aluminium 36. Corrugated Paper Board and Boxes 37. Pressure Die Casting up to 0.75kg 38. Rubber cord	48. Cotton Wool (Non-Absorbent) 46. Tent poles 47. Augur (carpenter) 48. Chrome tanned leather 49. Nuts & Bolts or Hand Tools of all Types or Distribution of Board up to 15 amps 50. Office furniture (Wooden chairs/Tables) 51. Pulley wires 52. Paper tapes (Gummed) 53. Insecticides Dust and Sprayers (Manual Only) 54. Street light fittings 55. Windshield wipers (arms and blade only) 56. Transistorized Insulation tester 57. Battery Eliminator, Voltage stabilizer 58. Transformer type welding set confirming

39. Distribution Board upto 15 amps 40. Artistic wooden furniture 41. Squirrel cage Induction Motor 42. Spiked Boots, Skiboots and shoes 43. Steel cross bars, cross arms, clamps, arching horn, brackets 44. Dust Shield leather 45. Domestic electric appliances – Food mixer, wet grinder and food processor 46. M S Tie bars 47. Naphthalene Balls	to IS 1291[1] 59. Hinges, Hasps and staples 60. Garments (excluding supply from Indian Ordnance Factory 61. Hand tools-Mechanical 62. Cane furniture handloom 63. Sluice valves 64. Wooden boards 65. Teak fabricated round blocks 66. Lubricators

Additional Import Substitutes

- Blood Bags - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study, Investment Opportunities, Cost and Revenue, Plant Economics.
- Liquid Organic Fertilizer (Biofertiliser)
- Selenium Coated Aluminium Drum Used In Plain Paper Copier - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study
- Soyabean Cultivation and Processing For Soy Nuggets (Nutrela), Paneer and Milk - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Plant Layout
- Natural Food Colours - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study, Investment Opportunities, Cost and Revenue
- IMFL, INDIAN MADE FOREIGN LIQUOR (WHISKEY, RUM, GIN, VODKA AND BRANDY) - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study
- SANITARY NAPKINS - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study, Investment Opportunities, Cost and Revenue, Plant Layout
- PHOTOCOPIER CLEANING WEB (Non Woven) - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials, Feasibility Study, Investment Opportunities

- MEDICAL DISPOSABLES: Disposable Syringes (Self Destructive) with Needles, Catheters and Mask - Manufacturing Plant, Detailed Project Report, Profile, Business Plan, Industry Trends, Market Research, Survey, Manufacturing Process, Machinery, Raw Materials

9. Technology Domains

Computer Engineering (Regional Language)	
25.	Data Science and Artificial Intelligence
26.	Block chain Technology
27.	Image Processing, Pattern Recognition and Computer Vision
28.	Natural Language Processing
29.	Cloud Computing/Edge Computing/Fog Computing
30.	Virtual Reality/Augmented Reality

31.	Gaming/Multimedia/Animation/ Computer Graphics
32.	Computational Biology
33.	Wireless Sensor Networks
34.	Machine Learning & Deep Learning
35.	Multi core Computing
36.	Quantum Computing
37.	Green Computing
38.	Human Computer Interaction
39.	ICT and E-learning
40.	Cybernetics, Virtualization and Parallel Computing
41.	Cryptography, Network Security and Cognitive networks
42.	Cognitive Learning
43.	Big Data Analytics
44.	Bioinformatics
45.	Soft Computing
46.	IOT & Sensor data mining
47.	High Performance Computing & Parallelization
48.	Robotic and Automation

List of Annexure:

1A. Tentative Activity Calendar of Major Project Stage-1
2A. Rubric Table for Review I Assessment of Major Project Stage-1
3A. Rubric Table for Review II Assessment of Major Project Stage-1
4A. Rubric Table for Oral Exam of Major Project Stage-1

Course Syllabus

BTech Semester - VIII

Program:	B. Tech. (Computer Engineering (Regional Language))				Semester: VIII		
Course:	Major Project Stage 2				Code: BCER8703		
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
14	-	07	14	100	100	-	200

Prior knowledge of
Software Engineering, Domain related subjects, Engineering Mathematics
is essential.

Course Objectives:

1. To understand the Project Development Process.
2. To develop problem solving ability by following Software Development Life Cycle meticulously.
3. To review literature for project work from appropriate sources such as books, manuals, research journals and from other sources, and in turn increase analytical skills.
4. To design and implement real world applications using available platforms.
5. To validate and evaluate the work undertaken.
6. To work in a team with individual contribution for the project development
7. To prepare good quality technical reports based on the selected project statement.

Course Outcomes:

After learning the course, the students will be able to:

1. Analyze the literature for various techniques and applications to find the gap and feasible solution.
2. Design real world applications considering emerging areas in technology.
3. Develop an application by considering actual requirements and social, environmental, ethical and legal issues
4. Test and evaluate the model results to develop a probable solution.
5. Work in a team with individual contribution for the project development.
6. Prepare good quality technical reports and present it effectively.

Guidelines:
Same as Course Major Project Stage -1 (Course Code: BCER8702A)

List of Annexure:

1B. Tentative Activity Calendar of Major Project Stage-2
2B. Rubric Table for Review III Assessment of Major Project Stage-2
3B. Rubric Table for Review IV Assessment of Major Project Stage-2
4B. Rubric Table for Oral Exam of Major Project Stage-2

Annexure

Annexure

Sr. No.	List of Annexure
1	Tentative Activity Calendar of Major Project
2	Rubric Table for Review I Assessment of Major Project
3	Rubric Table for Review II Assessment of Major Project
4	Rubric Table for Oral Exam of Major Project
1A	Tentative Activity Calendar of Major Project Stage - 1
2A	Rubric Table for Review I Assessment of Major Project Stage - 1
3A	Rubric Table for Review II Assessment of Major Project Stage - 1
4A	Rubric Table for Oral Exam of Major Project Stage - 1
1B	Tentative Activity Calendar of Major Project Stage - 2
2B	Rubric Table for Review III Assessment of Major Project Stage - 2
3B	Rubric Table for Review IV Assessment of Major Project Stage - 2
4B	Rubric Table for Oral Exam of Major Project Stage - 2
5	MOOC Course Approval Form

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Annexure 1: Tentative Activity Calendar of Major Project

Sr. No.	Project Activity	Time Line (Tentative)
1	Registration of Project teams and allotment of guide, Session on Project Guidelines.	First & second Week of First month
2	**Project Review (guide level) onProject Synopsis Evaluation:** Presentation of Project topic, Motivation, Literature Survey, Objectives & Methodology and Objective implementation on Literature Survey	Third week of First month
3	Synopsis Submission, Requirement Analysis and Project Design (Implementation of Objective on dataset preparation)	Fourth week of First month
4	Developed algorithms, Implementation of modules (25%) (Implementation of Objective on developing Modules)	First week of second month
5	Developed algorithms, Implementation of modules (50%) (Objective implementation on developing Modules)	Second week of second month
6	**Project Review 1:** Project topic, Literature Survey, Objectives, Project Design and Demonstration of Developed algorithms, Implementation of modules (50%) (Objective implementation on developing modules)	Third week of second month
7	Work on suggestions given in the previous review, coding and implementation of the project modules (75%)	Fourth week of second Month
8	Coding and implementation of complete project (100%), testing and validation (Objective implementation on developing and evaluation of Modules)	First & second weeks of Third Month
9	Paper writing and submission for publication in quality journal/conference or Patent filing process and Project Report writing	Third weeks of third Month
10	**Project Review 2:** Demonstrationon implementation of complete project (100%), testing and validation, paper and report documents	fourth weeks of third Month
11	Work on suggestions given in the previous review	fourth weeks of third Month
12	Submission of Project Report and all related documents(research paper documents, IPR/Copyrights if any, Completion certificate in case of sponsored project, plagiarism report, proofs of Project related competitions etc.)	Fourth Month

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Annexure 2: Rubric Table for Review I Assessment of Major Project

Performance Indicators (PI) (Five Performance levels will be considered in this assessment. 1. Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	Maximum Marks
1. **Problem Identification, Novelty, Innovation and Relevance of the topic-** Societal relevance, industry or research relevance, possible topic leading to patenting and multidisciplinary.	10
2. **Literature Survey:** Quality of references searched in order of increasing merit - Internet websites, Text Books, Reference Books, Hand Books, Conference papers (National), Conference papers (International), National Journal papers, International Journal Papers, Surveys. The total number should not more than 50 / product sources, web repositories, tools and techniques etc. through literature review.	10
3. **Objectives:** All the objectives of the proposed work are well defined. Objectives are measurable and attainable.	5
4. **Project planning**: Timely presentation of work plan, Clarity, provision of margin for activities etc.	5
5. **Requirement Analysis:** Requirements are identified and clear understanding of requirements	10
6. **Modeling and Design**: Quality and correctness in modeling and design	20
7. **Selection of Modern Tools & Techniques for project development**	5
8. **Coding and Implementation (50% expected)**: Workability of the project, obtaining the results, success in the outcome.	20
9. **Content of Presentation, Demonstration and Question-Answer:** Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained, Communication manners	10
10. **Punctuality and Team Work:** Punctual, Clear evidence of Team Work, work done with proper coordination and synchronization among team members. Individual Contribution in the project	5
Total Marks	**100**

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Annexure 3: Rubric Table for Review II Assessment of Major Project

Performance Indicators (PI) (Five Performance levels will be considered in this assessment. 1. Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	Maximum Marks
1. **Incorporation of Suggestions of earlier review:** Changes are made as per the suggestion received in the earlier review	5
2. **Coding and Implementation (100% expected)**: Workability of the project, obtaining the results, success in the outcome.	20
3. **Testing and Validations:** Appropriate quality of testing and validations with all test cases	20
4. **Documentation and Quality of the report:** Systematic Organization, Technical Content, Depth, apparent efforts put in the preparation of the report i.e. data collection, expression in own language, presentation of results, effectiveness of conclusion etc.	20
5. **Content of Presentation, Demonstration and Question- Answer:** Appropriate slides, content on slides is well organize, results are shown in tabular and graphical formats, interpretation of results is well explained, Communication manners	10
6. **Punctuality and Team Work:** Punctual, Clear evidence of Team Work, work done with proper coordination and synchronization among team members. Individual Contribution in the project	5
7. **Paper publication/ IPR/Participation in various contests/Awards / Consultancy/ sponsored project**	20
Total Marks	**100**

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Annexure 4: Rubric Table for Oral Exam of Major Project

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment.** 1**.** Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Problem Identification, Novelty, Innovation and Relevance of the topic- Societal relevance, industry or research relevance, possible topic leading to patenting and multidisciplinary.	10
2. Literature Survey: Quality of references searched in order of increasing merit - Internet websites, Text Books, Reference Books, Hand Books, Conference papers (National), Conference papers (International), National Journal papers, International Journal Papers, Surveys. The total number should not more than 50 / product sources, web repositories, tools and techniques etc. through literature review.	20
3. Requirement Analysis: Requirements are identified and clear understanding of requirements	20
4. Modeling and Design: Quality and correctness in modeling and design	20
5. Coding and Implementation: Workability of the project, obtaining the results, success in the outcome.	20
6. Testing and Validations: Appropriate quality of testing and validations with all test cases	20
7. Documentation and Quality of the report: Systematic Organization, Technical Content, Depth, apparent efforts put in the preparation of the report i.e. data collection, expression in own language, presentation of results, effectiveness of conclusion etc. outcome of documentation	20
8. Presentation and Question- Answer - Communication and manners, wishing, greeting, permission to begin, permission to proceed, Body Language, effectiveness in technical communication of the project topic, clarity of concepts, clarity in thought process, Technical Content, Depth, Communication Manners	20
Total Marks	**150**

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Annexure 1A: Tentative Activity Calendar of Major Project Stage - 1

Sr. No.	Project Activity	Time Line (Tentative)
1	Registration of Project teams and allotment of guide, Session on Project Guidelines.	First & second Week of First month
2	**Project Review (guide level) onProject Synopsis Evaluation:** Presentation of Project topic, Motivation, Literature Survey, Objectives & Methodology and Objective implementation on Literature Survey	Third week of First month
3	Work on suggestions given in the previous review. Synopsis submission	Fourth week of First month
4	Requirement Analysis and Project Design (Implementation of Objective on dataset preparation)	First week of second month
5	Requirement Analysis and Project Design (Implementation of Objective on dataset preparation)	Second week of second month
6	**Project Review 1:Project topic, Literature Survey, Objectives**, Project Design	Third week of second month
7	Work on suggestions given in the previous review, coding and implementation of the project modules (25%)	Fourth week of second Month
8	Developed algorithms, Implementation of modules (50%) (Objective implementation on developing Modules)	First & second weeks of Third Month
9	Paper writing for publication in quality journal/conference and Project Report writing	Third weeks of third Month
10	**Project Review 2:** Demonstrationon implementation of project (50%), testing and validation, paper and report documents	fourth weeks of third Month
11	Work on suggestions given in the previous review	fourth weeks of third Month
12	Submission of Project Report and all related documents(research paper documents, IPR/Copyrights if any, Offer letter in case of sponsored project, plagiarism report, proofs of Project related competitions etc.)	Fourth Month

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Annexure 2A: Rubric Table for Review I Assessment of Major Project Stage - 1

Performance Indicators (PI) (Five Performance levels will be considered in this assessment. 1. Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	Maximum Marks
1. **Problem Identification, Novelty, Innovation and Relevance of the topic-** Societal relevance, industry or research relevance, possible topic leading to patenting and multidisciplinary.	5
2. **Literature Survey:** Quality of references searched in order of increasing merit - Internet websites, Text Books, Reference Books, Hand Books, Conference papers (National), Conference papers (International), National Journal papers, International Journal Papers, Surveys. The total number should not more than 50 / product sources, web repositories, tools and techniques etc. through literature review.	10
3. **Objectives:** All the objectives of the proposed work are well defined. Objectives are measurable and attainable.	5
4. **Presentation and Question- Answer** - Communication and manners, wishing, greeting, permission to begin, permission to proceed, Body Language, effectiveness in technical communication of the project topic, clarity of concepts, clarity in thought process, Technical Content, Depth	5
5. **Project planning**: Timely presentation of work plan, Clarity, provision of margin for activities etc.	5
6. **Requirement Analysis:** Requirements are identified and clear understanding of requirements	5
7. **Punctuality and Team Work:** Punctual, Clear evidence of Team Work, work done with proper coordination and synchronization among team members. Individual Contribution in the project	5
8. **Modeling and Design**: Quality and correctness in modeling and design	10
Total Marks	**50**

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Annexure 3A: Rubric Table for Review II Assessment of Major Project Stage - 1

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment.** 1**.** Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Incorporation of Suggestions of earlier review: Changes are made as per the suggestion received in the earlier review	5
2. Selection of Modern Tools & Techniques for project development	5
3. Coding and Implementation (50% expected): Workability of the project, obtaining the results, success in the outcome.	10
4. Content of Presentation, Demonstration and Question-Answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained	5
5. Punctuality and Team Work: Punctual, Clear evidence of Team Work, work done with proper coordination and synchronization among team members. Individual Contribution in the project	5
6. Testing and Validations: Appropriate quality of testing and validations with all test cases	10
7. Documentation and Quality of the report: Systematic Organization, Technical Content, Depth, apparent efforts put in the preparation of the report i.e. data collection, expression in own language, etc.	10
Total Marks	**50**

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Annexure 4A: Rubric Table for Oral Exam of Major Project Stage - 1

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment.** 1**.** Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Problem Identification, Novelty, Innovation and Relevance of the topic- Societal relevance, industry or research relevance, possible topic leading to patenting and multidisciplinary.	5
2. Literature Survey: Quality of references searched in order of increasing merit - Internet websites, Text Books, Reference Books, Hand Books, Conference papers (National), Conference papers (International), National Journal papers, International Journal Papers, Surveys. The total number should not more than 50 / product sources, web repositories, tools and techniques etc. through literature review.	5
3. Requirement Analysis: Requirements are identified and clear understanding of requirements	5
4. Modeling and Design : Quality and correctness in modeling and design	10
5. Coding and Implementation (50%): Workability of the project, obtaining the results, success in the outcome.	5
6. Testing and Validations: Appropriate quality of testing and validations with all test cases	5
7. Documentation and Quality of the report: Systematic Organization, Technical Content, Depth, apparent efforts put in the preparation of the report i.e. data collection, expression in own language, presentation of results, effectiveness of conclusion etc. outcome of documentation	10
8. Presentation and Question- Answer - Communication and manners, wishing, greeting, permission to begin, permission to proceed, Body Language, effectiveness in technical communication of the project topic, clarity of concepts, clarity in thought process, Technical Content, Depth	5
Total Marks	**50**

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Annexure 1B: Tentative Activity Calendar of Major Project Stage - 2

Sr. No.	Project Activity	Time Line (Tentative)
1	Coding and implementation of the project modules (75%)	First & second Week of First month
2	Coding and implementation of complete project (100%) (Objective implementation on developing and evaluation of Modules)	Third week of First month
3	Testing and validation (Objective implementation on developing and evaluation of Modules)	Fourth week of First month
4	**Project Review 3:** Demonstrationon implementation of complete project (100%), testing and validation	First week of second month
5	Work on suggestions given in the previous review	Second week of second month
6	Paper writing for publication in quality journal/conference or Patent filing	Third week of second month
7	**Guide Level Review** to verify paper and suggesting quality conference or journal / Patent documents	Fourth week of second Month
8	Paper submission to quality journal / conference or patent filing process	First & second weeks of Third Month
9	Final Project Report writing and verification by guide	Third weeks of third Month
10	**Project Review 4:** Final paper / Patent and project report content presentation	fourth weeks of third Month
11	Work on suggestions given in the previous review	fourth weeks of third Month
12	Submission of Project Report and all related documents(research paper documents, IPR/Copyrights if any, Completion certificate in case of sponsored project, plagiarism report, proofs of Project related competitions etc.)	Fourth Month

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Annexure 2B: Rubric Table for Review III Assessment of Major Project Stage - 2

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment.** 1**.** Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Incorporation of Suggestions of earlier review : Changes are made as per the suggestion received in the earlier review	5
2. Coding and Implementation (100% expected): Workability of the project, obtaining the results, success in the outcome.	20
3. Testing and Validations: Appropriate quality of testing and validations with all test cases	10
4. Content of Presentation, Demonstration and Question-Answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained	10
5. Punctuality and Team Work: Punctual, Clear evidence of Team Work, work done with proper coordination and synchronization among team members. Individual Contribution in the project	5
Total Marks	**50**

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Annexure 3B: Rubric Table for Review IV Assessment of Major Project Stage - 2

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment.** 1**.** Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Incorporation of Suggestions of earlier review : Changes are made as per the suggestion received in the earlier review	5
2. Content of Presentation, Demonstration and Question-Answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained, Communication manners	5
3. Punctuality and Team Work: Punctual, Clear evidence of Team Work, work done with proper coordination and synchronization among team members. Individual Contribution in the project	5
4. Paper publication/ IPR/Participation in various contests/Awards / Consultancy/ sponsored project:	20
5. Documentation and Quality of the report: Systematic Organization, Technical Content, Depth, apparent efforts put in the preparation of the report i.e. data collection, expression in own language, etc.	15
Total Marks	**50**

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Annexure 4B: Rubric Table for Oral Exam of Major Project Stage - 2

Performance Indicators (PI) **(Five Performance levels will be considered in this assessment.** 1**.** Excellent, 2. Very Good, 3. Good, 4. Fair, 5. Poor)	**Maximum Marks**
1. Problem Identification, Novelty, Innovation and Relevance of the topic- Societal relevance, industry or research relevance, possible topic leading to patenting and multidisciplinary.	10
2. Literature Survey: Quality of references searched in order of increasing merit - Internet websites, Text Books, Reference Books, Hand Books, Conference papers (National), Conference papers (International), National Journal papers, International Journal Papers, Surveys. The total number should not more than 50 / product sources, web repositories, tools and techniques etc. through literature review.	10
3. Modeling and Design: Quality and correctness in modeling and design	10
4. Coding and Implementation (100%): Workability of the project, obtaining the results, success in the outcome.	20
5. Testing and Validations: Appropriate quality of testing and validations with all test cases	20
6. Documentation and Quality of the report: Systematic Organization, Technical Content, Depth, apparent efforts put in the preparation of the report i.e. data collection, expression in own language, presentation of results, effectiveness of conclusion etc. outcome of documentation	20
7. Content of Presentation, Demonstration and Question-Answer: Appropriate slides, content on slides is well organized, results are shown in tabular and graphical formats, interpretation of results is well explained, Communication manners.	10
Total Marks	**50**

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Annexure 5: MOOC Course Approval Form

Department: Academic Year: 20 -20 Date:

1. Student Name:		PRN No:	Year &Div :
2. Overall CGPA:		Phone :	
3. Student email address:			
4. Semester in which NPTEL course opted:			

NPTEL Course Details :

Sr. No.	Name of Course	Course Duration	Offering Institute	Substituting Course

The NPTEL courses opted by the student have been checked and found **OK/ Not OK**.

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Mentor MOOC Coordinator

Undertaking by the student:

I, _____, ROLL NO._____ will abide by the guidelines of the department for undertaking NPTEL courses and report the marks/grade/credits obtained would be duly communicated to my Mentor and MOOC Co-ordinator. The approval of the Mentor and MOOC Co-ordinatorwould be binding on me.

Signature of the student with Date:

Attachment : Proof of Course Registration

Vision and Mission of Computer Department

Department Vision

To be a premier Computer Engineering program by achieving excellence in Academics and Research for creating globally competent and ethical professionals.

Department Mission

M1: To develop technologically competent and self-sustained professionals through contemporary curriculum.
M2: To nurture innovative thinking and collaborative research, making a positive impact on society.
M3: To provide state-of-the art computing environment and learning opportunities through Center of Excellence.
M4: To foster leadership skills and ethics with holistic development.