Your Dreams Our Goal

POORNIMA UNIVERSITY

Member of Association of Indian Universities & Approved by UGC (Govt. of India) under 2(f) & 12(B)

FACULTY Of ENGINEERING AND TECHNOLOGY

PROGRAM: B. TECH

SCHEME & SYLLABUS BOOKLET

BATCH: 2025-2029

SCHEME & SYLLABUS

BATCH: 2025-29

FACULTY OF ENGINEERING AND TECHNOLOGY

PROGRAM: B. TECH

INDEX

Disclaimer: The scheme, syllabus and other materials published in this booklet may be changed or modified as per the requirement after approval of competent authority. The decision taken by the management of Poornima University will be final and abiding to all.

Student Details

Name of Student:

Name of Program:

Semester: Year: Batch:

Faculty of:

Your Dreams Our Goal

POORNIMA UNIVERSITY

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VISION

To create knowledge-based society with scientific temper, team spirit and dignity of labor to face global competitive challenges.

Mission

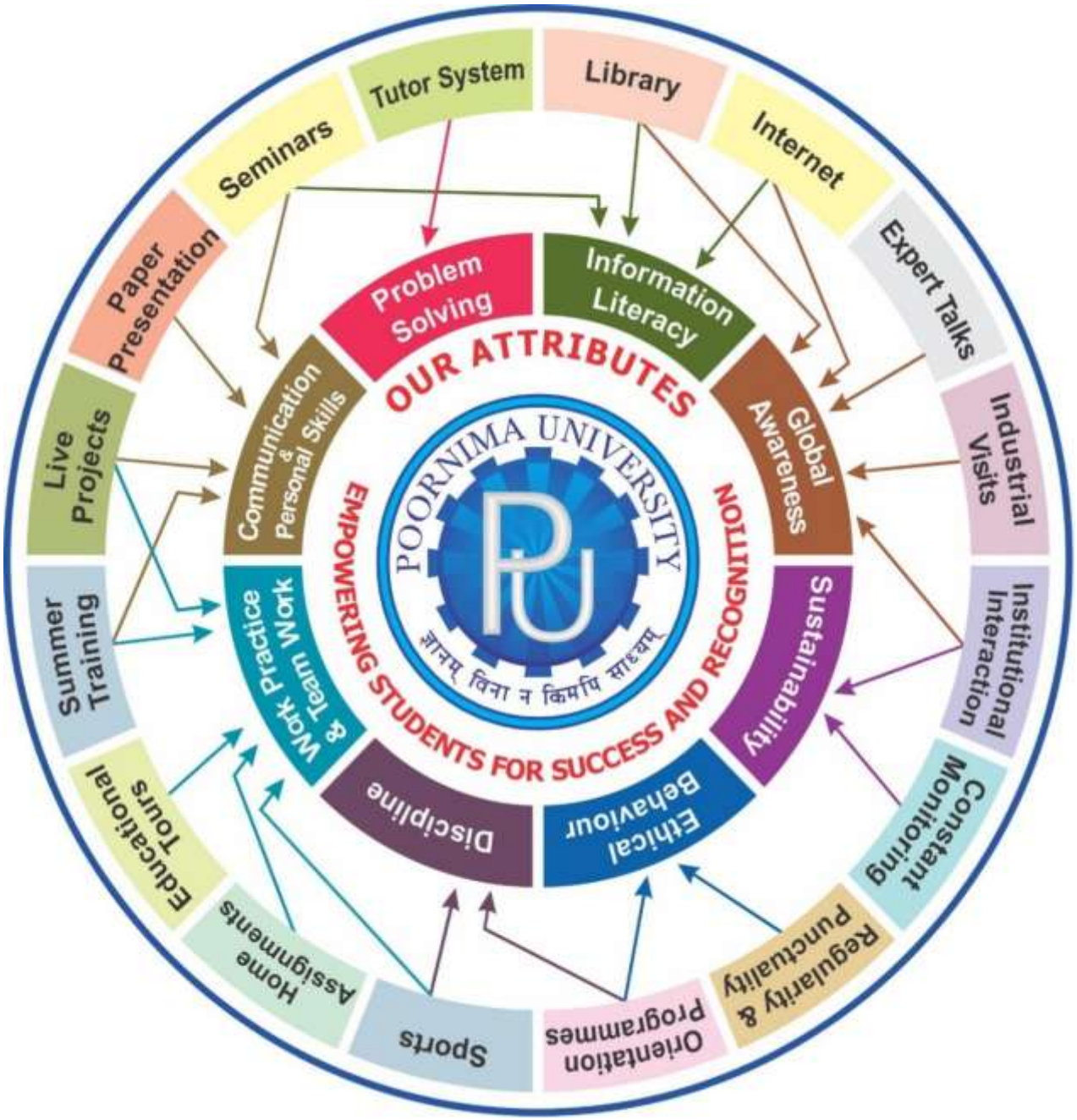
To evolve and develop skill-based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

Quality Policy

To provide Quality Education through Faculty development, updating of facilities and continual improvement meeting University norms and keeping stake holders satisfied.

Knowledge Wheel

At Poornima, the academic atmosphere is a rare blend of modern technical as well as soft skills and traditional systems of learning processes.



About Program and Program Outcomes (PO):

Title of the Programme: Bachelor of Technology (B. Tech.)

Nature of the Programme: B. Tech. is four-year full-time programme.

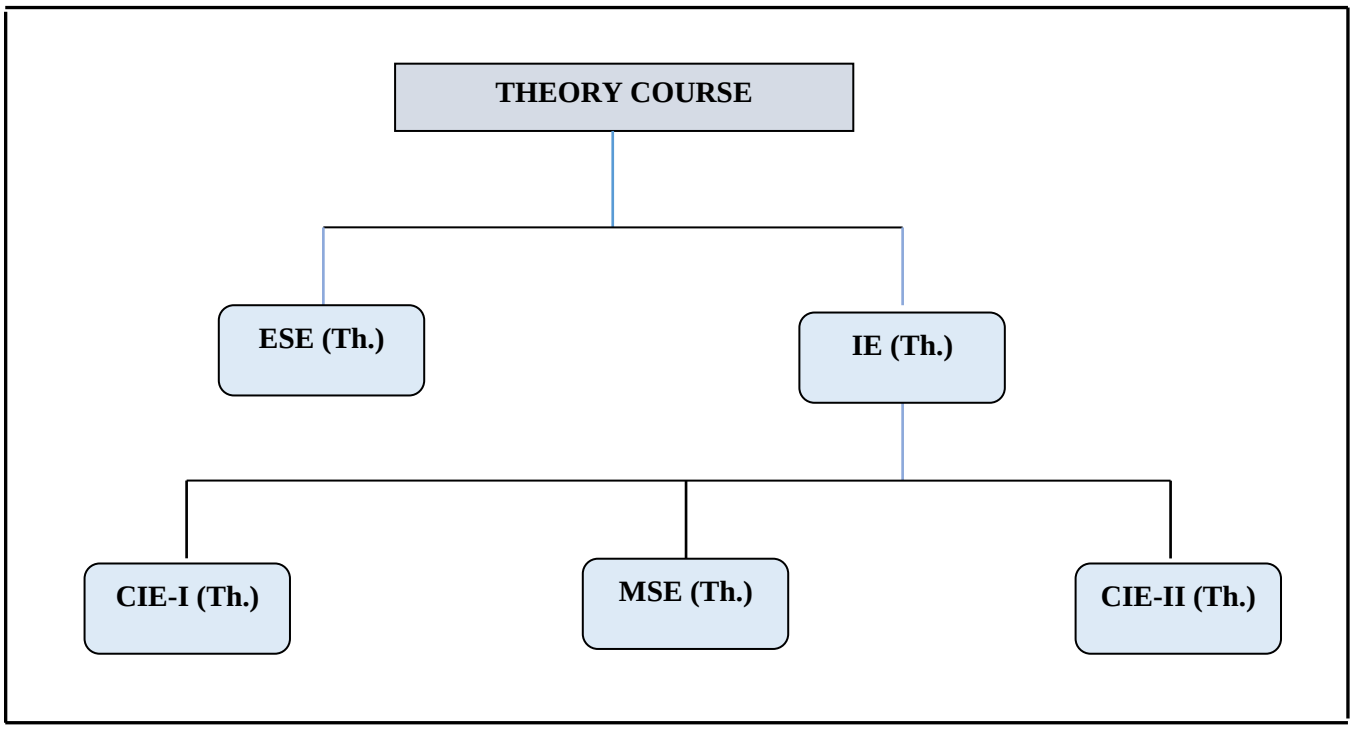
Program Outcomes (PO) :

Engineering Graduates will be able to:

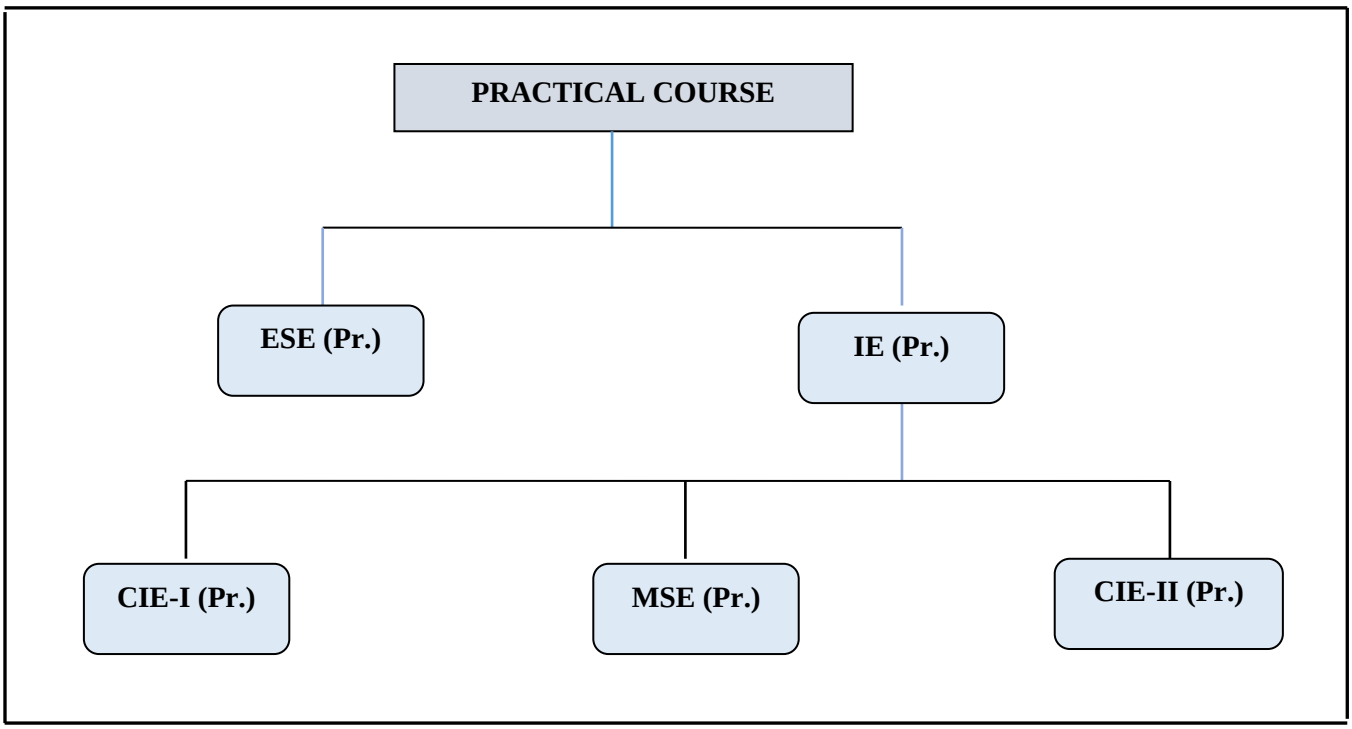
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Examination System:

A. Marks Distribution of Theory Course:



B. Marks Distribution of Practical Course:



Th.: Theory, Pr.: Practical, **ESE:** End Semester Examination, **MSE:** Mid Semester Examination, **CIE:** Continuous Internal Evaluation.

CO Wise Marks Distribution:

Exam Entity	Theory Subject		Practical/ Studio Subject	
	Maximum Marks	CO to be Covered	CO to be Covered	Maximum Marks
CIE-I	16 (8 + 8)	1 & 2	1 & 2	24 (12 + 12)
MSE	16 (8 + 8)	3 & 4	3 & 4	24 (12 + 12)
CIE-II (Activity/ Assignment)	8 (8)	5	5	12 (12)
ESE	60	-	-	40
TOTAL	100	-	-	100

Minimum Passing Percentage in All Exams:

S No.	Program Name	Minimum Passing Percentage in		
		IE Component	ESE Component	Total Component
1	Course Work for PhD Registration	**-**	**-**	**50%**
2	B. Arch.	**-**	**45%**	**50%**
3	MBA, MCA, M.Des., M.Tech., M.Plan, MHA, MPH, MA	**-**	**40%**	**40%**
4	B. Tech., B. Des., BVA, BCA, B.Sc., BBA, B.Com., B.A.	**-**	**35%**	**35%**

SGPA Calculation

$$SGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$SGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

C_i is the number of credits of subject i,

G_i is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course in the semester

CGPA Calculation

$$CGPA = \frac{C_1G_1 + C_2G_2 + \ldots\ldots\ldots + C_nG_n}{C_1 + C_2 + \ldots\ldots + C_n}$$

$$CGPA = \frac{\sum_i C_i \times G_i}{\sum_i C_i}$$

where (as per teaching scheme & syllabus):

C_i is the number of credits of subject i,

G_i is the Grade Point for the subject I and i = 1 to n,

n = number of subjects in a course of all the semesters up to which CGPA is computed

Grading Table:

Applicable for B.Arch. & Ph.D. Courses

Academic Performance	Grade	Grade Point	Marks Range (in %)
Outstanding	O	10	90≤ x ≤100
Excellent	A+	9	80≤ x <90
Very Good	A	8	70≤ x <80
Good	B+	7	60≤ x <70
Above Average	B	6	50≤ x <60
Fail	F	0	x <50
Absent	Ab	0	Absent

Applicable for All Courses except B.Arch. & Ph.D.

Academic Performance	Grade	Grade Point	Marks Range (in %)
Outstanding	O	10	90≤ x ≤100
Excellent	A+	9	80≤ x <90
Very Good	A	8	70≤ x <80
Good	B+	7	60≤ x <70
Above Average	B	6	50≤ x <60
Average	C	5	40≤ x <50
Pass	P	4	35≤ x <40
Fail	F	0	x <35
Absent	Ab	0	Absent

CGPA to percentage conversion rule:

Equivalent % of Marks in the Program = *CGPA* *10

Award of Class

CGPA	Percentage	Equivalent Division
7.50 ≤ CGPA	75% or more	First Division with Distinction
6.00 ≤ CGPA < 7.50	60% ≤ x <75%	First Division
5.00 ≤ CGPA < 6.00	50% ≤ x <60%	Second Division
4.00 ≤ CGPA < 5.00	40% ≤ x < 50%	Pass Class

Guidelines for Massive Open Online Courses (MOOCs)

(Session 2023-24)

Poornima University, in its never-ending endeavor to equip students with best-of-class learning and knowledge, has undertaken to include MOOC courses as part of its credit scheme from session 2023-24 onwards. The objective behind this is to enable students to study courses designed by the best teachers in the country and to scale their knowledge base with the rest of learners from the nation. The MOOCs which are included under this scheme is can be chosen from SWAYAM and NPTEL.

1. Introduction of MOOCs: SWAYAM and NPTEL

About SWAYAM:

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

This is done through a platform that facilitates hosting of all the courses, taught in classrooms to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to any learner. However, learners wanting a SWAYAM certificate should register for the final proctored exams that come at a fee and attend in-person at designated centers on specified dates. Eligibility for the certificate will be announced on the course page and learners will get certificates only if this criterion is matched.

The courses hosted on SWAYAM are in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology.

In order to ensure that best quality content is produced and delivered, nine National Coordinators have been appointed. They are:

1. AICTE (All India Council for Technical Education) for self-paced and international courses
2. NPTEL (National Programme on Technology Enhanced Learning) for Engineering
3. UGC (University Grants Commission) for non-technical post-graduation education
4. CEC (Consortium for Educational Communication) for under-graduate education
5. NCERT (National Council of Educational Research and Training) for school education
6. NIOS (National Institute of Open Schooling) for school education
7. IGNOU (Indira Gandhi National Open University) for out-of-school students
8. IIMB (Indian Institute of Management, Bangalore) for management studies
9. NITTTR (National Institute of Technical Teachers Training and Research) for Teacher Training programme

Two types of courses are offered on SWAYAM platform: Credit Courses and Non- Credit Courses. Credit courses are offered for each semester in January and July every year. The list is available on SWAYAM official website: https://onlinecourses.swayam2.ac.in/

About NPTEL:

NPTEL (National Programme on Technology Enhanced Learning), is a joint venture of the IITs and IISc, funded by the Ministry of Education (MoE) Government of India, and was launched in 2003. Initially started as a project to take quality education to all corners of the country, NPTEL now offers close to 600+ courses for certification every semester in about 22 disciplines.

Some highlights:

- Largest online repository in the world of courses in engineering, basic sciences and selected humanities and management subjects
- YouTube channel for NPTEL – most subscribed educational channel, 1.3 billion views and 40+ lakhs subscribers
- More than 56000 hours of video content, transcribed and subtitled
- Most accessed library of peer-reviewed educational content in the world
- Translation of more than 12000 hrs of English transcripts in regional Indian languages

NPTEL Online Certification:

The objective of enabling students obtain certificates for courses is to make students employable in the industry or pursue a suitable higher education programme. Through an online portal, 4, 8, or 12-week online courses, typically on topics relevant to students in all years of higher education along with basic core courses in sciences and humanities with exposure to relevant tools and technologies, are being offered. Enrolment to and learning from these courses is free. Following these online courses, an in-person, proctored certification exam is conducted and a certificate is provided through the participating institutions and industry, as applicable.

Some statistics regarding the open online courses since March 2014 till Dec 2021

Completed courses: 3496;

Enrollments across courses: 1.58 CRORE +

Number of exam registrations: 15.1 LAKH +

All the statistics pertaining to completed courses are available at https://beta.nptel.ac.in/courses.

All courses are completely free to enroll and learn from. The certification exam is optional and comes at a fee of Rs 1000/course exam.

2. MOOCs at Poornima University:

MOOCs envelops best in class teaching - learning processes along with meeting the requirements of various courses in terms of quality of teaching and evaluation system. To promote the MOOCs among students of Poornima University, it is decided to consider the credits earned through MOOCs.

(a) Options for MOOCs at Poornima University

(For this document, only those MOOCs will be considered which are available on SWAYAM & NPTEL platforms)

- Credit and Non-credit SWAYAM MOOCs can be opted by anyone, anytime, anywhere and in any language.

However, prior-permission of the University Authorities is mandatory if the credits are to be transferred to regular degree.

- In case of credit courses, there are two ways to opt these courses for the purpose of credit transfer to PU system as given below:

OPTION–I: As Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards):

Open Elective (for batches entered till 2022) / Multidisciplinary Courses (for batches admitted from 2023-24 onwards) are available at university level in offline mode for which relevant booklets are already published. **These courses carries 02 credits.** These category/types of courses (similar/different) are also available as MOOC courses. The respective Deans / HODs shall provide both the options to all the students to either select offline courses or MOOCs as per details given below:

- Deans / HODs shall prepare a list of upto 05 appropriate MOOC courses of 02/03 credits each, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students so that they can select any one course from the list, the credits **(only 02)** of which will be counted against Open Elective/ Multidisciplinary courses pertaining to that particular semester.
- If the students are not willing to opt for MOOC Open Elective/ Multidisciplinary course, they can proceed with the current offline practice of opting for Multidisciplinary courses.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.

OR

OPTION–II: As Major / Minor Courses:

- Deans / HODs shall identify a course of **03 credits** for each semester, well in advance (at-least 15 days prior to commencement of semester) and take approval from the Office of Dean, Academics / Pro-President, PU.
- After approval, the respective Deans / HODs shall circulate a notice to all their respective students citing that the particular course will be conducted through MOOCs only and is compulsory for all respective students. The credits of this course will be counted against Major/Minor courses pertaining to that particular semester.
- The tutor of the class shall monitor the progress (assignments, feedback, any problem etc.) on weekly basis and report to Head/Dean.
- This is to be noted that if Deans / HODs decide to conduct any major/minor course in any semester through MOOCs, no offline course will be conducted against that.

(b) Important points related to MOOCs at Poornima University

- Only one MOOC shall be allowed in a particular semester for the purpose of credit transfer in the beginning.
- No attendance will be taken for MOOC courses.
- Last period of T/T/S shall be taken for MOOC courses which shall be in self-study mode.
- The method of assessments of MOOC such as assignments and examination are completely associated with that particular MOOC and no exam will be conducted by the department as well as by the Examination Cell.

- The respective Dean / HOD must submit the detail of course i.e., code, name and credit of MOOC opted against that particular course in particular semester attached with highlighting in the related examination scheme of syllabus of that semester signed by BOS Convener / HoD and Dean of Faculty to the office of Pro-President before commencement of the classes.
- SWAYAM will award a certificate to all the students passing the examination along with the credit earned. The center of examination for SWAYAM MOOCs will be finalized by SWAYAM. All the responsibility related to registration for MOOCs, timely submission of assignments, examinations etc. will be borne by the students only.
- The list of registered students in MOOC along with name of course will be submitted to the Examination Cell by the Deans / HoDs before commencement of the classes.
- Any student who would not be able to register/present/clear/pass the MOOC in the stipulated time, it is the choice of the student that he or she may register in next semester (odd or even) with MOOC again or appear as a back exam candidate of the University as per PU norms.
- There will be no provision of re-evaluation of MOOC.
- The scorecard and related certificate of MOOC along with a consolidated list of students with marks of assignment and final exam will be submitted to the examination cell by the concerned Dean / HOD for further process. It is also recommended that alteration/changes/scaling in marks obtained by the students in any MOOC will not be considered.
- The exam registration fee of MOOC up to Max. INR 1000/- will be reimbursed to the student only after successful completion of the course in first attempt and submission of the fee receipt, score-card and certificate of the MOOC to the concerned department within stipulated time after declaration of the results.

NOTE: This is to be noted that the procedure for getting approval from BOS, Faculty Board, Academic Council and BoM is to be followed as per regular process.

Attached Items:

Open Elective Booklet	Annexure-1
Soft Skills Booklet	Annexure-2
Value Added Course Booklet	Annexure-3

POORNIMA UNIVERSITY, JAIPUR
Faculty of Engineering and Technology

Name of Program: B.Tech. (Common for all) **Duration: 4 Years** **Total Credits: 171**

Teaching Scheme for Batch 2025-29

Semester-I

Course Code	Name of Course	Teaching Scheme			Marks Distribution			Credits
		Lecture (L)	Tutorial (T)	Practical (P)	IE	ESE	Total	
A.		**Major (Core Courses)**						
A.1	**Theory**							
BTXCSA1101 BTXCSA1102	Engineering Physics **OR** Engineering Chemistry	3	-	-	40	60	100	3
BTXCCE1103	Programming in C	3	-	-	40	60	100	3
BTXCCV1104 BTXCEE1105	Basics of Civil Engineering **OR** Basics of Electrical and Electronics Engineering	3	-	-	40	60	100	3
BTXCSA1106 BTXCME1107	Engineering Mathematics **OR** Basic of Mechanical Engineering	3	-	-	40	60	100	3
BTXCSA1108	Environmental Studies	2	-	-	40	60	100	2
A.2	**Practical**							
BTXCSA1201 BTXCSA1202	Engineering Physics Lab **OR** Engineering Chemistry lab	-	-	2	60	40	100	1
BTXCCE1203	Programming in C Lab	-	-	2	60	40	100	1
BTXCCV1204 BTXCEE1205	Computer Aided Design (CADD) **OR** Basics of Electrical and Electronics Engineering Lab	-	1	2	60	40	100	1
BTXCME1206 BTXCME1207	Workshop Practice **OR** Engineering Graphics	-	1	2	60	40	100	1

B.		**Minor Stream Courses/ Department Electives**						
B.1	**Theory**	-	-	-	-	-	-	-
B.2	**Practical**	-	-	-	-	-	-	-
C		**Multidisciplinary Courses**						
	-	-	-	-				
D		**Ability Enhancement Courses (AEC)**						
BEACHM1205	Applied English Communication Skills-I	-	-	2	60	40	100	1
E		**Skill Enhancement Courses (SEC)**						
BELCSE1201	Skill Enhancement Course-I	-	-	2	60	40	100	1
F		**Value Added Courses (VAC)**						
BUVCVD1202 BUVCVH1201/ BUVCVA1201/ BUVCVD1201	Exploratory Project **OR** Human Values & Professional Ethics/ Performing Arts/ Entrepreneurship	-	-	2	60	40	100	1
G		**Summer Internship / Research Project / Dissertation**						
Total		14	2	14				**21**
Total Teaching Hours		**30**						

POORNIMA UNIVERSITY, JAIPUR
Faculty of Engineering and Technology

Name of Program: B.Tech. (ME, CV, EC, EE&CE) **Duration: 4 Years** **Total Credits: 171**

Teaching Scheme for Batch 2025-29

Semester-II

Course Code	Name of Course	Teaching Scheme			Marks Distribution			Credits
		Lecture (L)	Tutorial (T)	Practical (P)	IE	ESE	Total	
A.		**Major (Core Courses)**						
A.1	**Theory**							
BTXCSA2101 BTXCSA2102	Engineering Physics **OR** Engineering Chemistry	3	-	-	40	60	100	3
BTXCCE2104	Programming in Python	3	-	-	40	60	100	3
BTXCCV2105 BTXCEE2106	Basic of Civil Engineering **OR** Basics of Electrical and Electronics Engineering	3	-	-	40	60	100	3
BTXCSA2107 BTXCME2108	Engineering Mathematics **OR** Basic of Mechanical Engineering	3	-	-	40	60	100	3
A.2	**Practical**							
BTXCSA2201 BTXCSA2202	Engineering Physics lab **OR** Engineering Chemistry lab	-	-	2	60	40	100	1
BTXCCE2204	Programming in Python Lab	-	-	2	60	40	100	1
BTXCCV2205 BTXCEE2206	Computer Aided Design (CADD) **OR** Basics of Electrical and Electronics Engineering Lab	-	-	2	60	40	100	1
BTXCME2207 BTXCME2208	Workshop Practice **OR** Engineering Graphics	-	-	2	60	40	100	1
B.		**Minor Stream Courses/ Department Electives**						
B.1	**Theory**							
	Professional Elective - I	2	-	-	40	60	100	2

B.2	**Practical**							
	Nil	-	-	-	-	-	-	
C		**Multidisciplinary Courses**						
	MOOC Course-I	2	-	-				2
D		**Ability Enhancement Courses (AEC)**						
BEACHM2212	Quantitative & Verbal Aptitude Training-I	0	0	2	60	40	100	1
E		**Skill Enhancement Courses (SEC)**						
BELCSE2201	Skill Enhancement Course-II	-	-	2	60	40	100	1
F		**Value Added Courses (VAC)**						
BUVCVD2202 BUVCVH2201/ BUVCVA2201/ BUVCVD2201	Exploratory Project **OR** Human Values & Professional Ethics/ Performing Arts/ Entrepreneurship	-	-	2	60	40	100	1
G		**Summer Internship / Research Project / Dissertation**						
		-	-	-				
Total		16	0	14				**23**
Total Teaching Hours		**30**						

Professional Elective - I

Course Code	Name of Course
BTXECE2111	Introduction To Cloud Technology
BTXEME2112	Engineering Mechanics
BTXECE2113	Introduction To Cyber Security
BTXECE2114	Introduction To Emerging Technology
BTXECE2115	Introduction To Internet of Things
BTXECE2116	Probability & Statistics for Data Analysis
BTXECE2117	Introduction To Artificial Intelligence
BTXECE2118	Front End Development

POORNIMA UNIVERSITY, JAIPUR
Faculty of Engineering and Technology

Name of Program: B. Tech. Mechanical Engineering **Duration: 4 Years** **Total Credits: 171**

Teaching Scheme for Batch 2025-29

Semester-III

Course Code	Name of Course	Teaching Scheme			Marks Distribution			Credits
		Lecture (L)	Tutorial (T)	Practical (P)	IE	ESE	Total	
A.		**Major (Core Courses)**						
A.1	**Theory**							
BMECSA3101	Engineering Mathematics – II	3	0	0	40	60	100	3
BMECME3102	Mechanics of Solids	3	0	0	40	60	100	3
BMECME3103	Engineering Thermodynamics	3	0	0	40	60	100	3
A.2	**Practical**							
BMECME3201	Material Science and Material Testing Lab	0	0	2	60	40	100	1
BMECME3202	IOT and Robotics Lab	0	0	2	60	40	100	1
BMECME3203	Additive Manufacturing and Prototyping Lab	0	0	2	60	40	100	1
BMECME3204	Technical Seminar	0	0	2	60	40	100	1
BMECME3205	Computer Aided Design Lab –I	0	0	2	60	40	100	1
B.		Minor Stream Courses / **Department Electives**						
B.1	**Theory (Any one)**							
BMEEME3111	Material Science and Characterization Techniques	3	0	0	40	60	100	3
BMEEME3112	Operation Management							
BMEEME3113	Smart Technologies for Industry 4.0							
B.2	**Practical**							
C		**Multidisciplinary Courses**						
BMEEBX3109	MOOC Course-II	2	0	0				2
D		**Ability Enhancement Courses (AEC)**						
BUACHM3215	Professional Skills - I	0	0	2	40	60	100	1
E		**Skill Enhancement Courses (SEC)**						
BULCSE3201	Skill Enhancement Generic Course-III	0	0	2	60	40	100	1
F		**Value Added Courses (VAC)**						
BUVCVE3101	Green Built Environment	2	0	0	40	60	100	2
G		**Summer Internship / Research Project / Dissertation**						
	-	16		14				**23**
Total Teaching Hours		**30**						

POORNIMA UNIVERSITY, JAIPUR Faculty of Engineering and Technology								
Name of Program: B.Tech. in Mechanical Engineering			**Duration: 4 Years**				**Total Credits: 171**	
Teaching Scheme for Batch 2025-29								
Semester-IV								
Course Code	**Name of Course**	**Teaching Scheme**			**Marks Distribution**			**Credits**
		Lecture (L)	**Tutorial (T)**	**Practical (P)**	**IE**	**ESE**	**Total**	
A.		**Major (Core Courses)**						
A.1	**Theory**							
BMECME4101	Design of Machine Elements	3	0	0	40	60	100	3
BMECME4102	Automobile and IC Engine	3	0	0	40	60	100	3
BMECME4103	Manufacturing Processes	3	0	0	40	60	100	3
BMECME4104	Fluid Mechanics and Fluid Machines	3	0	0	40	60	100	3
A.2	**Practical**							
BMECME4201	Automobile and IC Engine Lab	0	0	2	60	40	100	1
BMECME4202	Manufacturing Technology Lab- I	0	0	2	60	40	100	1
BMECME4203	Fluid Mechanics and Fluid Machines Lab	0	0	2	60	40	100	1
	Minor Stream Courses / Department Electives							
B.1	**Theory**							
BMEEME4111	Non-Destructive Evaluation and Testing	3	0	0	40	60	100	3
BMEEME4112	Automation and Robotics							
BMEEME4113	Mechatronics							
B.2	**Practical**							
C		**Multidisciplinary Courses (MC)**						
BMEEBX4109	MOOC Course-III	2	0	0	40	60	100	2
D		**Ability Enhancement Courses (AEC)**						
BUACHM4224	Human Values & Professional Ethics	0	0	2	60	40	100	1
E		**Skill Enhancement Courses (SEC)**						
BULCSE4201	Skill Enhancement Generic Course-IV	0	0	2	60	40	100	1
BULCSE4202	Skill Enhancement Technical Course-I	0	0	2	60	40	100	1
F		**Value Added Courses (VAC)**						
	-	-	-	-				
G		**Summer Internship / Research Project / Dissertation**						
Total		17	0	12				**23**
Total Teaching Hours		**29**						

POORNIMA UNIVERSITY, JAIPUR
Faculty of Engineering and Technology

Name of Program: B.Tech. in Mechanical Engineering **Duration: 4 years** **Total Credits: 171**

Teaching Scheme for Batch 2025-29

Semester-V

Course Code	Name of Course	Teaching Scheme			Marks Distribution			Credits
		Lecture (L)	Tutorial (T)	Practical (P)	IE	ESE	Total	
A.		**Major (Core Courses)**						
A.1	**Theory**							
BMECME5101	Theory of Machines	3	0	0	40	60	100	3
BMECME5102	Manufacturing Science and Technology	3	0	0	40	60	100	3
BMECME5103	Power Plant Engineering	3	0	0	40	60	100	3
BMECME5104	Heat and Mass Transfer	3	0	0	40	60	100	3
A.2	**Practical**							
BMECME5201	Manufacturing Technology Lab-II	0	0	2	60	40	100	1
BMECME5202	Theory of Machines & Vibration Lab	0	0	2	60	40	100	1
BMECME5203	Thermal Engineering Lab	0	0	2	60	40	100	1
BMECME5204	Computer Aided Design Lab-II	0	0	2	60	40	100	1
B.	**Minor Stream Courses / Department Electives**							
B.1	Theory (Any One)							
BMEEME5111	Industrial Engineering							
BMEEME5112	Finite Element Method							
BMEEME5113	Product Design and Development	3	0	0	40	60	100	3
B.2	Practical							
C	**Multidisciplinary Courses**							
BMEEBX5109	MOOC Course-IV	2	0	0				2
D	**Ability Enhancement Courses (AEC)**							
BUACHM5228	Professional Skills-II	0	0	2	60	40	100	1
E	**Skill Enhancement Courses (SEC)**							
BULCSE5201	Skill Enhancement Generic Course-V	0	0	2	60	40	100	1
F		**Value Added Courses (VAC)**						
		-	-	-				
G		**Summer Internship / Research Project / Dissertation**						
Total		17	0	12				23
Total Teaching Hours		**29**						

POORNIMA UNIVERSITY, JAIPUR
Faculty of Engineering and Technology

Name of Program: B.Tech. in Mechanical Engineering **Duration: 4 Years** **Total Credits: 171**

Teaching Scheme for Batch 2025-29

Semester-VI

Course Code	Name of Course	Teaching Scheme			Marks Distribution			Credits
		Lecture (L)	Tutorial (T)	Practical (P)	IE	ESE	Total	
A.		**Major (Core Courses)**						
A.1	**Theory**							
BMECME6101	AI/ML in Smart Manufacturing	3	0	0	40	60	100	3
BMECME6102	Refrigeration and Air Conditioning	3	0	0	40	60	100	3
BMECME6103	Operation Research	3	0	0	40	60	100	3
BMECME6104	Computer Integrated Manufacturing	3	0	0	40	60	100	3
BMECME6105	Ancient Indian Metallurgy (As per IKS)	3	0	0	40	60	100	3
A.2	**Practical**							
BMECME6201	Computer Aided Engineering Lab	0	0	2	60	40	100	1
BMECME6202	Refrigeration and Air Conditioning Lab	0	0	2	60	40	100	1
BMECME6203	CNC Programming Lab	0	0	2	60	40	100	1
BMECME6204	Electric Vehicle and Drone Lab	0	0	2	60	40	100	1
BMECME6205	Computational Fluid Dynamics Lab	0	0	2	60	40	100	1
B.		**Minor Stream Courses/ Department Electives**						
B.1	**Theory (Any One)**							
BMEEME6111	Total Quality Management	3	0	0	40	60	100	3
BMEEME6112	Unconventional Machining Processes							
BMEEME6113	Renewable Energy Technology							
B.2	**Practical**							
C		**Multidisciplinary Courses**						
		-	-	-				-
D		**Ability Enhancement Courses (AEC)**						
		-	-	-				
E		**Skill Enhancement Courses (SEC)**						
	-	-	-	-				
F		**Value Added Courses (VAC)**						
	-	-	-	-				
G		**Summer Internship / Research Project / Dissertation**						
BMECME6301	Minor Project	0	0	4	60	40	100	2
Total		18	0	14				**25**
Total Teaching Hours		**32**						

POORNIMA UNIVERSITY, JAIPUR
Faculty of Engineering and Technology

Name of Program: B.Tech. in Mechanical Engineering **Duration: 4 Years** **Total Credits: 171**

Teaching Scheme for Batch 2025-29

Semester-VII

Course Code	Name of Course	Teaching Scheme			Marks Distribution			Credits
		Lecture (L)	Tutorial (T)	Practical (P)	IE	ESE	Total	
A.		**Major (Core Courses)**						
A.1	**Theory**							
BMECME7101	MOOC Course –V (as Described in Annexure-II)	3	0	0	40	60	100	3
A.2	**Practical**							
BMECME7201	Industrial Training Seminar	0	0	4	60	40	100	2
B.		**Minor Stream Courses / Department Electives**						
B.1	**Theory**							
	-							
B.2	**Practical**							
	-							
C		**Multidisciplinary Courses**						
	-	-	-	-				
D		**Ability Enhancement Courses (AEC)**						
	-	-	-	-				
E		**Skill Enhancement Courses (SEC)**						
	-	-	-	-				
F		**Value Added Courses (VAC)**						
	-	-	-	-				
G		**Summer Internship / Research Project / Dissertation**						
BMECME7401	Internship	0	0	12	40	60	100	6
Total		3	0	16				**11**
Total Teaching Hours		**19**						

POORNIMA UNIVERSITY, JAIPUR
Faculty of Engineering and Technology

Name of Program: B.Tech. in Mechanical Engineering **Duration: 4 Years** **Total Credits: 171**

Teaching Scheme for Batch 2025-29

Semester-VIII

Course Code	Name of Course	Teaching Scheme			Marks Distribution			Credits
		Lecture (L)	Tutorial (T)	Practical (P)	IE	ESE	Total	
A.	**Major (Core Courses)**							
A.1	**Theory**							
BMECME8101	Six Sigma & Lean Manufacturing	3	0	0	40	60	100	3
BMECME8102	Tribology & Maintenance Engineering	3	0	0	40	60	100	3
A.2	**Practical**							
BMECME8201	Energy Audit Lab	0	0	2	60	40	100	1
BMECME8202	Academic Research Paper Writing and IPR	0	0	2	60	40	100	1
BMECME8203	Programming in MATLAB	0	0	2	60	40	100	1
B.	Minor Stream Courses/**Department Electives**							
B.1	**Theory**							
BMEEME8111	Industrial Internet of Things	3	0	0	40	60	100	3
BMEEME8112	Ergonomics and Work Place Design							
BMEEME8113	Reliability and Maintenance Engineering							
B.2	**Practical**							
C	**Multidisciplinary Courses**							
		-	-	-				
D	**Ability Enhancement Courses (AEC)**							
		-	-	-				
E	**Skill Enhancement Courses (SEC)**							
		-	-	-				
F	**Value Added Courses (VAC)**							
		-	-	-				
G	**Summer Internship / Research Project / Dissertation**							
BMECME8301	Major Project			20	60	40	100	10
Total		9		26				**22**
Total Teaching Hours		**35**						

Code: BTXCSA1101/2101	Engineering Physics	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (CO):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping
CO1	Differentiate between Diamagnetism, Para magnetism and ferromagnetism	L1	PO1, PO2, PO3, PO4, PO6, PO7
CO2	Understand the principle behind Newton's rings interference pattern, its construction using a plano- convex lens and a flat glass plate	L1	PO1, PO2, PO3, PO4, PO6, PO7
CO3	Explain the concept of matter waves and describe their wave-particle duality using the de Broglie wavelength equation.	L1	PO1, PO2, PO3, PO4, PO6, PO7
CO4	Provide a solid foundation for understanding the principles behind many electronic devices and applications like Hall effect, PN Junction	L3	PO1, PO2, PO3,PO4,PO5 PO6, PO7
CO5	Comprehensive foundation in the principles and applications of light amplification, He-Ne laser, and holography	L3	PO1, PO2, PO3, PO4, PO6, PO7

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	3	-	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	1	-	-
WT. AV G	2.6	2.4	2.2	-	-	-	-	-	-	-	-	-	2.4	-	-

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO 3	PSO4	PSO5
CO1	-	-	-	-	1
CO2	-	-	-	-	1
CO3	-	-	-	-	1
CO4	-	-	-	-	1
CO5	-	-	-	-	1
Wt. AVG	-	-	-	-	1

D. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Material Science**	**07**
2.	**Wave optics**	**07**
3.	**Quantum Mechanics**	**08**
4.	**Semiconductor Physics**	**08**
5.	**Laser and Holography**	**06**

E. DETAILED SYLLABUS

Unit	Unit Details
1.	**Material Science**
	• Introduction of Unit • Fundamentals of Crystal structure, • Para-magnetism, Diamagnetism, Ferromagnetism, Ferrimagnetism, Antiferromagnetic, Magnetic Permeability, Magnetization, Paramagnetic Susceptibility of Solid Substances, and Explanation of Hysteresis. • Conclusion of Unit
2.	**Wave optics**
	• Introduction of Unit • Interference of light, Types of Interference, coherent source, methods to produce coherent sources with examples. • Newton's rings: Principle, Construction, working and Applications, Anti Reflection Coating. • Fundamental idea about optical fiber, types of fiber, acceptance angle, numerical aperture. • Conclusion of Unit
3.	**Quantum Mechanics**
	• Introduction of Unit • Matter waves and properties. Group and Particle velocities & their relationship. • Compton scattering, wave function and its properties. • Heisenberg Uncertainty principle. • Time dependent and time independent Schrodinger wave equation. • Conclusion of Unit
4.	**Semiconductor Physics**
	• Introduction of Unit • Energy bands in semiconductors, • Types of semiconductors, Charge carriers, • Intrinsic and extrinsic materials, Carrier Concentration, Conductivity and Mobility, • Hall effect, • PN Junction diode, Zener diode, Solar Cell • Conclusion of Unit
5.	**Laser and Holography**
	• Introduction of Unit • Introduction of LASER, Conditions for the Light Amplification, • Population Inversion and metastable state, pumping. • Types of lasers: He-Ne laser and diode laser and their working principle and Holography • Conclusion of Unit

F. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1	Materials Science and Engineering	by Raghavan V	Latest	PHI
2	Fundamentals Of Engineering Physics	SS Rawat	Latest	CBH Publications
3	Solid State Physics	By S. O. Pillai	Latest	NEW AGE
4	Concepts of modern physics	Beiser, Arthur	Latest	Mc Graw Hill
5	Introduction to Quantum Mechanics	David J. Griffiths and Darrell F. Schroeter	Latest	Cambridge University Press
Important Web Links				
1	https://jiet.claybits.com/			
2	https://jiet.claybits.com/physics/1-5			
3	https://jiet.claybits.com/physics/3-1			

Code: BTXCSA1102/2102	ENGINEERING CHEMISTRY	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Enumerate the importance, synthesis and applications of polymers.	L2	PO1, PO2, PO3, PO4, PO6, PO7
CO2	Illustrate the fundamental principles of water chemistry, applications of volumetric and analytical instrumentation	L1	PO1, PO2, PO3, PO4, PO6, PO7
CO3	Explain the fundamental concepts of corrosion, its control and surface modification methods namely electroplating and electroless plating	L2	PO1, PO2, PO3, PO4, PO6, PO7
CO4	Impart the basic knowledge of chemistry and its principals involved in electrochemistry, energy storage devices and its commercial applications	L3	PO1, PO2, PO3, PO4, PO5 PO6, PO7
CO5	Learn about the manufacturing of cement and the chemistry involved in setting and hardening of it and also learn about the suitable use of lubricants	L2	PO1, PO2, PO3, PO4, PO6, PO7

B. Mapping matrix of CO & PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	1	1	-	-	-	-	-
CO2	2	1	2	1	-	2	2	-	-	-	-	-
CO3	3	2	2	1	-	2	2	-	-	-	-	-
CO4	3	1	2	1	1	2	2	-	-	-	-	-
CO5	2	1	1	1	-	2	2	-	-	-	-	-
Wt. AVG	2.6	1.2	1.6	1	1	1.8	1.8					

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	1
CO2	-	-	-	-	1

CO3	-	-	-	-	1
CO4	-	-	-	-	1
CO5	-	-	-	-	1
Wt. AVG	-	-	-	-	1

D. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Polymer Basics and Applications**	7
2.	**Water Chemistry and methods of analysis**	8
3.	**Corrosion and Metal finishing**	**7**
4.	**Electrochemistry and energy storage systems**	7
5.	**Engineering Materials**	**7**

E. DETAILED SYLLABUS

Unit	Unit Details
1.	**Polymer Basics and Applications**
	• Introduction of Unit • Introduction to Polymer chemistry: • Classification of Polymers and Types of polymerization • Plastics: Thermosets and Thermoplastics, Preparation, Properties and Uses of Polyethylene, Bakelite, Teflon, and Nylon • Flexible materials: Natural rubber, Vulcanization, Synthetic rubber- Preparation, Properties and Applications of SBR, Buna-N and flexible materials. • Conclusion of Unit
2.	**Water Chemistry and Methods of Analysis**
	• Introduction of Unit Water • Sources of water, Impurities in water and effect of impurities • Municipal water supply: Requisites of drinking water, Alkaline Water: Benefits, Side Effects and Dangers • Steps involved in purification of water, Sedimentation, Coagulation, Filtration and Disinfection, Break Point Chlorination • Water Analysis: Hardness of water; Type of hardness, Degree of hardness, Units of hardness, Disadvantages of hard water, Determination of hardness by Complexometric (EDTA) method, Numerical based on hardness by EDTA method • Treatment of hard water: Lime-soda method, Permutit (zeolite) method, RO water treatment and Deionization or Demineralization method • Conclusion of Unit
3.	**Corrosion and Metal Finishing**
	• Introduction of the Unit • Definition of corrosion and its Significance • Mechanisms of Corrosion: Chemical (Dry) corrosion and Electrochemical (Wet) corrosion • Types of corrosion: Galvanic corrosion, Concentration cell corrosion, Stress corrosion, Pitting corrosion • Methods of protection against corrosion: Galvanization, Sacrificial coatings etc. • Metal finishing: Technological importance, Electroplating and Electroless plating • Conclusion of Unit

4.	**Electrochemistry and Energy Storage Systems**
	• Introduction of the Unit • EMF of cell, Free Energy, Single electrode potential, Nernst equation, Numerical problems based on Nernst Equation. • Electrodes: Calomel electrode and Glass electrode • Energy storage Systems: Introduction, Classification of batteries. Construction, working and applications of Li-ion batteries. • An electrochemical energy system for electric vehicles. Recycling of Lithium-ion batteries by direct cycling Method. • Conclusion & Real life applications.
5.	**Engineering Materials**
	• Introduction of the Unit • Portland Cement; Definition, Manufacturing by Rotary kiln. Chemistry of setting and hardening of cement. Role of Gypsum. • Lubricants: Classification, Mechanism, Properties; Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number. • Conclusion & Real life applications

F. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Publication
1	Engineering chemistry: A Text book	S.K. Jain & K.D. Gupta	Jaipur Publishing House
2	Engineering chemistry: A Text book	S.S. Dara	S. Chand & Co
3	Engineering chemistry: A Text book	P.C. Jain	Dhanpat Rai & Sons.

Code: BTXCCE1103	Programming in C	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Learn data types, loops, functions, array, pointers, string, structures and files	L2	PO1, PO2, PO3, PO4, PO6, PO7
CO2	Develop conditional and iterative statements to write C programs	L1	PO1, PO2, PO3, PO4, PO6, PO7
CO3	Implement concept of string using array.	L2	PO1, PO2, PO3, PO4, PO6, PO7
CO4	Allocate memory dynamically using pointers	L3	PO1, PO2, PO3,PO4,PO5 PO6, PO7
CO5	Application of file handling and dynamic memory allocation	L2	PO1, PO2, PO3, PO4, PO6, PO7

B. Mapping matrix of CO & PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**2**	-	-	**1**	-	-	-	-	-
CO2	**3**	**2**	**3**	**3**	-	-	**2**	-	-	-	-	-
CO3	**2**	**2**	**1**	**1**	-	-	**2**	-	-	-	-	-
CO4	**3**	**1**	**2**	**1**	-	-	**2**	-	-	-	-	-
CO5	**2**	**2**	**1**	**1**	-	-	**2**	-	-	-	-	-
Wt. AVG	2.6	2	1.8	1.8			1.8					

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-		
CO2	2	-	-		
CO3	2	-	-		
CO4	**3**	-	-		
CO5	2	-	-		
Wt. AVG	2.4				

D. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Introduction to C Programming**	**7**
2.	**Decision Making & Looping**	**7**
3.	**Array and string**	**7**
4.	**Advance programming in C**	**8**
5.	**File handling & Additional features**	**7**

E. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to C Programming**
	• Introduction of Unit • Introduction to computer-based problem solving, Program design and implementation issues- Flowcharts & Algorithms. • Types of Languages – Machine language, assembly language, high level languages, Assemblers, Compilers, Interpreters. • Overview of C, Data Types, Constants & Variables, Literals, Operators & Expressions • Conclusion &Real Life Application
2.	• **Decision Making & Looping**
	• Introduction of Unit • Decision making in C- if statement, if-else statement, Nested if statement, if else if Ladder, Switch case, Ternary Operator • Loop control in C – for loop, while loop, do-while loop • Control flow in C- break, continue and goto statement. • Conclusion &Real Life Application
3.	• **Array and string**
	• Introduction of Unit • Types of arrays: One-dimensional, Two-dimensional. • Array memory representation • Array indexing and traversal • Operations on Arrays: Reading, Inserting, Deleting, searching • Advantages and limitations • Functions: Definition and need for functions, Advantages of using functions • Function declaration, definition, and call : Syntax and structure in C • Types of Functions: Built-in Functions, User-defined Functions • Function Parameters: Call by Value, Call by Reference • Recursion: Concept of recursion, Base case and recursive case • Scope rules- Local & global variables. • String : Definition of strings and memory representation • String declaration and initialization • Standard library functions (e.g., strlen, strcpy, strcmp, strcat in C) • Conclusion of the Unit
4.	• **Advance programming in C**
	• Introduction of Unit • Pointers- The & and * operator, pointer expression, assignments, arithmetic, comparison, arrays of pointers, pointers to pointers, initializing pointers, pointers to functions, function returning pointers. • Advance features- storage classes and dynamic memory allocation(• Structures- Basics, declaring, referencing structure elements, array of structures, passing structures to functions, structure pointers, arrays and structures within structures, typedef. • Unions – Declaration, uses • Enumerated data-types • Conclusion of the Unit
5.	• **File handling & Additional features**

	• Introduction of Unit • File Handling – The file pointer, file accessing functions-fopen, fclose, putc, getc, fprintf, reading and writing into a file • C Preprocessor- #define, #include, #undef, Conditional compilation directives. • C standard library and header files: Header files, string functions, mathematical functions, Date and Time functions. • Conclusion of the Unit

F. RECOMMENDED STUDY MATERIAL:

S. No	Reference **Book**	**Author**	**Publication**
1.	Letus C, 6th Edition	Yashwant Kanitkar	PBP Publication
2.	The C programming Language	Richie and Kenninghan	BPBPublication,2004
3.	Programming in ANSI C3rd Edition, 2005	E.Balagurusamy	Tata McGraw Hill
Reference Book			
1	The C programming Language Richie and Kenninghan PBP Publication,2004		
2	Programming in ANSI C 3rd Edition, 2005 Balaguruswmy Tata McGraw Hill		
Online resources			
1	https://www.programiz.com/c-programming/examples		
2	https://www.w3resource.com/c-programming-exercises		

Code: BTXCCV1104/2105	**Basics of Civil Engineering**	**3 Credits [LTP: 3-0-0]**

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (CO):	At the end of this course, learners will be able to:	Bloom Level
CO1	**Understand** the various aspect of civil engineering, its novel areas and Career Prospects in Civil Engineering.	L1
CO2	**Demonstrate** the characteristics of different Construction Materials and constrtuction techniques in Civil Engineering.	L1
CO3	**Identify** the various building components, and **analyze** the construction methods and basic principles.	L4
CO4	**Understand** different types of surveying works required in construction and compare diffenent surveying instruments.	L1
CO5	**Understand** about the recent advancements in Civil Engineering.	L1

B. MAPPING MATRIX OF CO,PO, & PSO

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	-	-	-	-	-	-	-	-	1	-	3
CO2	2	3	1	2	-	-	-	-	-	-	-	-	2	-	3
CO3	3	2	2	2	-	-	-	-	-	-	-	-	1	-	3
CO4	3	3	1	2	-	-	-	-	-	-	-	-	1	-	3
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	-	3
WT. AVG	2.8	2.6	1.6	1.8									1.6		3

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-		
CO2	2	-	-		
CO3	2	-	-		
CO4	**3**	-	-		
CO5	2	-	-		
Wt. AVG	2.4				

D. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction to Civil Engineering	**08**
2.	Construction Materials and techniques	**08**
3.	Building Construction	**08**
4.	Basic Surveying	**08**
5.	Advancements in Civil Engineering	**08**

E. DETAILED SYLLABUS

Unit	Unit Details
1	**Introduction to Civil Engineering**
	• Introduction • Different disciplines of Civil Engineering, Scope and prospects • Role of a Civil Engineer • Units of measurement, Unit conversion (Length, Area, Volume) • Infrastructure Engineering, Sustainability • Automation and Robotics in Construction • Novel areas in Construction industry • Career Prospects in Civil Engineering
2	**Construction Materials and techniques**
	• Introduction • Cement – Types, properties, grades, Concrete– PCC and RCC, Cement mortar • Stone, Requirements of good building stone, General types of stone used in Construction. • Bricks, Modular and Standard bricks, Characteristics of good brick, Special bricks –fly ash bricks. • Timber, Structure of timber, General properties and uses of good timber, Use of bamboo in construction • Asphalt, bitumen and tar used in construction, their properties and uses • Types of Stone Masonry (Rubble masonry, Ashlar Masonry) and Brick Masonry (English bond and Flemish bond).
3	**Building Construction**
	• Introduction • Classification of Buildings as per National Building Code Group A to I • Types of Constructions- Load Bearing Structure, Framed Structure, Composite Structure • Building Components - Functions of Building Components, Substructure-Foundation, Plinth & Superstructure. • Selection of site for different types of Buildings • Basic principles of building planning. • Pre-engineered steel building, Pre-fabricated buildings
4	**Basic Surveying**
	• Introduction • Survey – Principles, purpose and use • Types & Classification of surveying • Instruments used in chain survey: Chains, Tapes, Arrow, Ranging rod, Line ranger, Offset rod, Open cross staff, Optical square • Ranging: Direct and Indirect Ranging • Methods of chaining, obstacles in chaining.

	• Errors in chain and tape, Numerical based on errors in length due to incorrect length of chain & tape. • Modern surveying instruments– EDM, Total station, GPS
5	**Advancements in Civil Engineering**
	• Introduction • Smart city and it's features, Plastic Roads • Mass Transportation systems-BRTS, Metro • Green building, Rain water harvesting systems • Affordable housing & their features • Building Information Modeling (BIM), 3D Printing Technology for Construction, Advanced Civil Engineering Materials

F. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1	Basics of Civil Engineering	S.S. Bhavikatti	Latest	New Age International Publishers
2	Basic Civil Engineering	B C Punmia, Ashok K Jain, Arun K Jain	Latest	Laxmi Publications
3	Basic Civil Engineering	G K Hiraska	Latest	Dhanpat Rai Publication
4	Basic Civil Engineering	Jhonson Victor D and Esther Malini	Latest	Allied Publishers Limited, Madras
5	Basic Civil Engineering	Arunachalam N	Latest	Pratheeba Publishers, Coimbatore

Important Web Links	
1	https://archive.nptel.ac.in/courses/105/106/105106201/
2	https://onlinecourses.nptel.ac.in/noc22_ce42/preview

Code: BTXCEE1105/2106	Basics of Electrical and Electronics	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (CO):	At the end of this course, learners will be able to:	Bloom Level
CO1	Apply basic electrical concepts, including various circuit analysis techniques and fundamentals of theorem to solve numerical problem related to basic electrical circuit.	L4
CO2	Demonstrate the fundamentals of AC circuits and Electric Installation by calculating voltage, current, impedance, and power factors.	L1
CO3	Compare various electrical machines and the process of energy conversion specifying the type and characteristics of the power source supplying these machines, such as AC or DC, voltage levels, frequency, etc.	L3
CO4	Understand the fundamental principles of semiconductor devices such as diodes and transistors, knowing their roles in switching and amplification.	L1
CO5	Understand the working principles of communication systems, Transducers and fundamentals of IoT.	L1

B. MAPPING MATRIX OF CO,PO, & PSO

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO2	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**2**	**2**	**-**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
CO4	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
CO5	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**-**	**-**
WT. AVG	**2.2**	**2.6**	**1**	**2**			**1**					**1**	**2.2**		

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-		
CO2	2	-	-		
CO3	2	-	-		
CO4	**3**	-	-		
CO5	2	-	-		
Wt. AVG	2.4				

D. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Basic Concepts of Electrical Engineering	08
2.	Alternating Quantities and Electrical Installations	08
3.	Electrical Machines	07

4.	Basic Electronics	08
5.	Communication Systems and IoT	08

E. DETAILED SYLLABUS

Unit	Unit Details
1.	Basic Concepts of Electrical Engineering
	• Introduction of Unit • Basic circuit elements and sources; Ohms law; Kirchhoff's laws; Series and Parallel connection of circuit elements; Star-delta transformation; • Mesh current analysis; Node voltage analysis; • Theorems: Statement and Numerical Problems of Thevenin's and Norton theorem • Conclusion of Unit
2.	Alternating Quantities and Electrical Installations
	• Introduction of Unit • Alternating voltages and currents: RMS, average, maximum values, Single Phase RL, RC, RLC series circuits, Power in AC circuits, Power Factor, • Electrical Safety, Fuses and Earthing • Conclusion of Unit
3.	Electrical Machines
	• Introduction of Unit • Construction, working principle and applications of DC Machines, Single phase Transformers, Three phase Induction motors, Single phase induction motors. • Special machines -Stepper motor, Universal motor and BLDC motor • Conclusion of Unit
4.	Basic Electronics
	• Introduction of Unit • Characteristics: PN junction diode, Zener diode, Rectifier, Voltage regulator. • Digital Electronics: Boolean algebra, Binary System, Logic Gates and Their Truth Tables. • Conclusion of Unit
5.	Communication Systems and IoT
	• Introduction of Unit • Basics of Communication: Types of Communication, Amplitude and Frequency Modulation. • Introduction to Transducers, Thermocouple, RTD, Load Cell and Bimetallic Strip. • An overview of Internet of Things-Building blocks of IoT, IoT enabling technologies, Characteristics of IoT systems • Conclusion of Unit

F. RECOMMENDED STUDY MATERIAL

S.No	Reference Book	Author	Edition	Publication
1	Electrical and Electronic Technology	Edward Hughes et al,	Latest	Pearson Publication
2	Basic Electrical & Electronics Engineering	V. Jagathesan, K. Vinod Kumar & R. Saravan Kumar	Latest	Wiley India
3	Basic Electrical & Electronics Engineering	Van Valkenburge	Latest	Cengage learning
4	Basic Electrical and Electronics Engineering by,	Muthusubrmaniam	Latest	TMH
5	Basic Electrical & Electronics Engineering	Ravish Singh	Latest	TMH
Important Web Links				
1	https://nptel.ac.in/courses/108108076/			
2	https://nptel.ac.in/courses/117103063/			
3	https://nptel.ac.in/courses/108/101/108101091/			

Code: BTXCSA1106 /2107	ENGINEERING MATHEMATICS	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Calculating eigen values and eigen vector	L4	PO1, PO5, PO6,
CO2	Determining ordinary differential equation and its types.	L3	PO1. PO2, PO3
CO3	Sketching standard curves using curve tracing.	L3	PO1, PO2, PO3, PO4
CO4	Calculating gamma function and double integration.	L4	PO1, PO2, PO3, PO4,
CO5	Associating Gradient, Divergence and Curl, Directional derivatives	L2	PO1, PO2, PO4

B. Mapping matrix of CO & PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	--	1	1	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-
CO3	3	2	3	1	-	-	-	-	-	-	-	-
CO4	3	2	1	1	-	-	-	-	-	-	-	-
CO5	2	1		1	-	-	-	-	-	-	-	-
Wt. AVG	2.8	2	2.3	1	1	1	-	-	-	-	-	-

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	-	-
CO2	3	-	-	-	-
CO3	3	-	-	-	-
CO4	3	-	-	-	-
CO5	3	-	-	-	-
Wt. AVG	3	-	-	-	-

D. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Matrices	7
2.	Ordinary Differential Equations	8
3.	Applications of Differential Calculus	8
4.	Integral Calculus	8
5.	Vector Calculus	8

E. DETAILED SYLLABUS

Unit	Unit Details
1.	**Matrices**
	• Introduction of Unit • Rank of a Matrix, Normal form of a Matrix • Consistency of systems of linear equations

	• Eigen Values and Eigen Vectors • Cayley-Hamilton Theorem (without proof) • Conclusion of Unit
2.	**Ordinary Differential Equations**
	• Introduction of Unit • Linear Equation and reducible to linear form, Exact Equation, Reducible to Exact • First order and first-degree differential equations-Separable Variables, • Homogenous and reducible to homogenous equation • Linear Equation and reducible to linear form, Exact Equation • Linear differential equations with constant coefficients • Conclusion of Unit
3.	**Applications of Differential Calculus**
	• Introduction of Unit • Asymptotes • Multiple points • Curve tracing for standard Curves (Cartesian Curves only) • Conclusion & Real-life applications
4.	**Integral Calculus**
	• Introduction of Unit • Gamma functions and their properties • Double integrals, Double integral by changing into polar form • Areas by Double Integration • Change of order of integration • Conclusion of Unit
5.	**Vector Calculus**
	• Introduction of Unit • Scalar and Vector field • Differentiation and Integration of Vector functions • Gradient, Divergence and Curl • Conclusion of Unit

F. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Higher Engineering Mathematics	B S Grewal	Latest	Khanna Publications, Delhi,
2.	Higher Engineering Mathematics	Ramana, B.V	Latest	Tata McGraw-Hill.
3	Engineering Mathematics: A Tutorial Approach	Ravish R Singh and M Bhatt	Latest	Tata McGraw-Hill
4	Calculus and Analytical Geometry	Thomas and Finney,	Latest	Narosa Publishing, New Delhi
5	Advanced Engineering Mathematics	Erwin Kreyszig	Latest	John Wiley and Sons
Important Web Links:				
1	https://nptel.ac.in/courses/111105134/			
2	https://nptel.ac.in/courses/122/101/122101001/			
3	https://www.classcentral.com/course/swayam-engineering-mathematics-i-13000			

Code: BTXCME1107/ 2108	Basic of Mechanical Engineering	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Understand the fundamentals of various manufacturing processes, including casting, forming, and additive manufacturing, and identify their real-life industrial applications.	L2	PO1, PO2, PO5
CO2	Demonstrate the knowledge of thermodynamic laws and apply them to refrigeration and air-conditioning systems.	L2	PO1, PO2, PO3, PO5
CO3	Explain the construction of automobiles, working principles, and performance parameters of internal combustion engines.	L3	PO1, PO2, PO3, PO5
CO4	Illustrate the concepts of aerodynamics, electric vehicle architecture, and evaluate the performance of electric vehicles.	L3	PO1, PO2, PO5
CO5	Describe the basic elements of automation and robotics, including control systems.	L2	PO1, PO2, PO5, PO6, PO7, PO8

B. Mapping matrix of CO & PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	2	-	-	2	-	-	-	-	-	-	-
CO2	3	3	-	-	2	-	-	-	-	-	-	-
CO3	3	3	2	-	2	-	-	-	-	-	-	-
CO4	3	2	2	-	2	-	-	-	-	-	-	-
CO5	3	2	-	-	2	1	2	2	-	-	-	-
Wt. AVG	**3**	**2.4**	**2**		**2**	**1**	**2**	**2**				

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3
CO1	-	-	3
CO2	-	-	3
CO3	2	-	3
CO4	-	-	3
CO5	2	-	2
Wt. AVG	**2**		**2.8**

D. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Manufacturing Processes	9
2	Thermal Engineering	9
3	Automobile and IC Engines	8
4	Aerodynamics and Electric Vehicles	7
5	Automation and robotics	7

E. DETAILED SYLLABUS

Unit	Unit Details
1	**Manufacturing Processes**
	Introduction of Unit **Metal Casting Process:** Introduction to casting process, sand casting, pattern and their types, pattern materials, moulding sand, casting defects. **Metal Forming Processes**: Introduction to metal forming, hot and cold working process, Forging, Rolling, Extrusion, Drawing. **Additive manufacturing:** Introduction, definition of AM by ASTM, types of AM, Fused Deposition Modeling (FDM) and Laser Powder Bed Fusion (LPBF) Conclusion of Unit including Real Life Application
2	**Thermal Engineering**
	Introduction of Unit **Thermodynamics:** Thermodynamic system, surroundings, boundary, state, characteristics, process, cycle, zeroth law, first law and second law of thermodynamics. **Refrigeration and air conditioning:** classification and types of refrigeration systems, vapour compression system, vapour absorption system, and window air-conditioning system. Conclusion of Unit including Real Life Application
3	**Automobile and IC Engines**
	Introduction of Unit **Automobile:** historical development of automobiles, automobile components, types of automobiles. **IC Engine**: Heat engine, types of heat engine, component of IC Engine, working principle of SI and CI engine, two stroke and four stroke engines. Theoretical and actual indicator diagrams, performance parameters of IC Engines, calculation of power - efficiency. Conclusion of Unit including Real Life Application
4	**Aerodynamics and Electric Vehicles**
	Introduction of Unit **Aerodynamics:** introduction, jet engine, types of jet engine, aerodynamic forces, turbojet engine. **Electric Vehicles:** Architecture of an electric vehicle, essentials and performance of electric vehicles –Traction motor characteristics, tractive effort, transmission requirements, vehicle performance, advantage and limitations, battery heat management system. Conclusion of Unit including Real Life Application
5	**Automation and robotics**
	Introduction of Unit **Automation:** Basic elements, flexible manufacturing system (FMS), level of automation, hardware component of automation, types of automation, control system, open loop and closed loop system, social issues of automation

	Robotics: Definition of robot, history of robot, law of robotics, classification of robot, SCARA robot, advantage, limitations and application, social issues of robotics Conclusion of Unit including Real Life Application

F. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Edition	Publication
1	Manufacturing technology Volume I	P N Rao	Latest	McGraw Hill Publication
2	Basics of Mechanical Engineering	R.K. Rajput	Latest	Laxmi Publication
3	IC Engines	V. Ganesan	Latest	McGraw Hill Publication
4	Automobile Engineering Vol-1	Dr. Kripal Singh	Latest	Standard Publishers and Distributors Pvt Ltd
5	Engineering Thermodynamics	PK Nag	Latest	McGraw Hill Publication
6	Basics Of Mechanical Engineering	S Ramachandran	Latest	AIR WALK Publication
7	A Text Book of Hybrid Electric Vehicles	Dr. S. Vijaya Kumar	Latest	Iterative International Publishers IIP
8	Automation and Robotics	Dr. Shailendra Singh Chauhan	Latest	Walnut Publication

Code: BTXCSA1108	ENVIRONMENTAL STUDIES	2 Credits [LTP: 2-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Introduction to scope of environmental studies & concept of ecology, ecosystemand biodiversity.	L2	PO7, PO8, PO12,
CO2	Implement innovative ideas of controlling different categories of Environmental Pollution.	L3	PO7, PO8, PO11, PO12,
CO3	Environmental issues & various Environmental Acts, regulations and International Agreements.	L2	PO7, PO8, PO11, PO12,
CO4	Social issues related to population, resettlement and rehabilitation of project affected persons. Demonstrate disaster management w.r.t floods, earthquakes, cyclones and landslides.	L2	PO7, PO8, PO11, PO12,
CO5	Determination of local environmental assets with simple ecosystems and identify local flora and fauna	L4	PO7, PO8, PO11, PO12,

B. Mapping matrix of CO & PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	–	**2**	**2**	–	–	–	**1**
CO2	–	–	–	–	–	–	**3**	**2**	–	–	**1**	**1**
CO3	–	–	–	–	–	–	**2**	**3**	–	–	**1**	**1**
CO4	–	–	–	–	–	–	**3**	**2**	–	–	**1**	**1**
CO5	–	–	–	–	–	–	**2**	**3**	–	–	**1**	**1**
Wt. AVG							**2.4**	**2.4**			**1**	**1**

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	–	–	**1**	–	–
CO2	–	**1**	**1**	–	–
CO3	–	**1**	**1**	–	–
CO4	–	**1**	**1**	–	–
CO5	–	**1**	**1**	–	–
Wt. AVG		**1**	**1**		–

D. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Environmental Studies	5

2.	Environmental Pollution and its Control	5
3.	Environmental Policies & Practices	5
4.	Human Communities and the Environment	5
5.	Field Work	4

E. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Environmental studies**
	• Introduction of Unit • Multidisciplinary nature of environmental studies Concept of sustainability and sustainable development. • Ecosystem: Structure and function of ecosystem • Energy flow in an ecosystem: food chains, food webs and ecological succession.Case studies\ • Case studies of the following ecosystems: Forest ecosystem, Grassland ecosystem,Desert ecosystem • Aquatic ecosystems • Biodiversity and Conservation • Conclusion of the Unit
2.	**Environmental Pollution and its Control**
	• Introduction of Unit • Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution • Nuclear hazards and human health risks • Solid waste management: Control measures of urban and industrial waste. • Pollution case studies • Conclusion of the Unit
3.	**Environmental Policies & Practices**
	• Introduction of Unit • Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture • Energy resources: Renewable and non-renewable energy sources, use of alternate energy • sources, growing energy needs, case studies. • Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. • International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD) • Conclusion of the Unit
4.	**Human Communities and the Environment**
	• Introduction of Unit • Human population growth: Impacts on environment, human health and welfare. • Resettlement and rehabilitation of project affected persons; case studies. • Disaster management: floods, earthquake, cyclones and landslides. • Conclusion of the Unit
5.	**Field Work**
	• Introduction of Unit • Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. • Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. • Study of common plants, insects, birds and basic principles of identification. • Study of simple ecosystems-pond, river, Delhi Ridge, etc. • Conclusion of the Unit

F. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Edition	Publication
1	Environmental Studies	ErachBarucha	Latest	UGC
2	Environmental Studies	Benny Joseph	Latest	Tata McgrawHill
3	Environmental Studies	R. Rajagopalan	Latest	Oxford University Press
4	Principles of Environmental Scienceand Engineering	P. Venugoplan Rao	Latest	Prentice Hall of India.
5	Environmental Science and Engineering	Meenakshi	Latest	Prentice Hall India.

Code: BTXCSA1201 /2201 ENGINEERING PHYSICS LAB 1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course outcomes	On completion of this course, the students will be able:	Bloom Level
CO-1	To perform experiment and determine the wavelength using newton's ring setup & dispersive power of prism for violet, red & yellow color using spectrometer	L4
CO-2	To perform experiment and determine wavelength of prominent lines of mercury by plane diffraction grating using spectrometer	L3
CO-3	To measure the numerical aperture of an optical fiber and the coherent length and coherent time by using He-Ne Laser.	L3
CO-4	Determine the Band Gap of the semiconductor in the form of reverse biased P-N junction diode and determine forward and reverse bias resistance for semiconductor diode.	L5
CO-5	To determine the height of a given line drawn on wall by sextant, determine time constant (both current and voltage graphs are to be plotted)	L5

B. MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**2**	**2**	**2**	-	-	-	-	-	-	**2**	**2**	-	—	3
CO2	**3**	**3**	**2**	-	-	-	-	-	-	-	**2**	**3**	-	—	3
CO3	**2**	**3**	**2**	-	-	-	-	-	-	-	**2**	**3**	-	—	3
CO4	**3**	**3**	**1**	**2**	-	-	-	-	-	-	**1**	**3**	-	—	3
CO5	**3**	**3**	**1**	-	-	-	-	-	-	-	**2**	**3**	-	—	3
Average	**3**	**2.8**	**1.6**	**2**	-	-	-	-	-	-	**1.8**	**2.8**	-	-	3

C. List of Experiment –

1.	To determine the wavelength of Sodium light by Newton's Ring.
2.	To determine the dispersive power of material of a prism for violet, red & yellow colour of Mercury light with the help of spectrometer.
3.	To determine the wavelength of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
4.	To verify the expression for the Resolving Power of Telescope.
5.	To measure the numerical aperture of an optical fiber by He-Ne Laser.
6.	To determine the coherent length and coherent time by using He-Ne Laser.
7.	To study the variation of a semiconductor resistance with temperature and hence determine the Band Gap of the semiconductor in the form of reverse biased P-N junction diode.
8.	To study the characteristics of semiconductor diode and determine forward and reverse bias resistance.
9.	To determine the height of a given line drawn on wall by sextant.
10.	To study Charging and Discharging of a condenser and determine time constant (both current and voltage graphs are to be plotted)

Add-ons Experiments	
11.	To determine the high resistance by method of leakage, using a Ballistic Galvanometer.
12.	To specify the specific resistance of a material of a given wire by Carey Foster's bridge.

Virtual Lab Link: https://www.vlab.co.in/

Code: BTXCSA1202/ 2202 ENGINEERING CHEMISTRY LAB 1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Analyze the strength of NaOH and Na_2CO_3 solutions	L2	PO1, PO2, PO3, PO4, PO6, PO7
CO2	Measure hardness and chloride content of water	L1	PO1, PO2, PO3, PO4, PO6, PO7
CO3	Analyze hardness strength of Ferrous Ammonium sulphate solution and CuSO4 solution	L2	PO1, PO2, PO3, PO4, PO6, PO7
CO4	Determine the different properties of lubricating oil	L3	PO1, PO2, PO3,PO4,PO5 PO6, PO7
CO5	Use different instruments & analytical techniques.	L2	PO1, PO2, PO3, PO4, PO6, PO7

B. Mapping matrix of CO, PO & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	1	1	-	-	-	-	-
CO2	2	1	2	1	-	2	2	-	-	-	-	-
CO3	3	2	2	1	-	2	2	-	-	-	-	-
CO4	3	1	2	1	1	2	2	-	-	-	-	-
CO5	2	1	1	1	-	2	2	-	-	-	-	-
Wt. AVG	2.6	1.2	1.6	1	1	1.8	1.8					

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	1
CO2	-	-	-	-	1
CO3	-	-	-	-	1
CO4	-	-	-	-	1
CO5	-	-	-	-	1
Wt. AVG	-	-	-	-	1

D. LIST OF EXPERIMENTS

1	To determine the strength of NaOH and Na_2CO_3 in a given alkali mixture.
2	To determine the strength of Ferrous Ammonium sulphate solution with the help of $K_2Cr_2O_7$ solution using diphenyl amine as internal indicator.
3	To determine the hardness of water by EDTA method.
4	To determine the amount of chloride content in drinking water
5	To determine the strength of $CuSO_4$ solution with the help of hypo solution.

6	To determine the acid value of a given oil.
7	To determine the viscosity of a given lubricating oil by Redwood viscometer.
8	To determine the flash and fire point of a given lubricating oil.
9	To determine the cloud and pour point of a given oil.
10	Synthesis of Bakelite.
Add-ons Experiments	
11	Determination of pH by pH-metric titration.
12	Estimation of an acid (weak/strong) by Conductometric titration.

E. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Publication
1	Engineering Chemistry	Dr. Mahima Tulsian	Jhunjhunuwala Publication
2	Engineering Chemistry Lab Manual	Dr. N. Rama Jyothi	Shine Book publication
3	Chemistry	Dr. Sanjay Sharma	College Book House

Virtual Lab Link: https://www.vlab.co.in/

Code: BTX CCE1203	Programming in C lab	1 Credits [LTP: 0-0-2]

COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Gain concept of functional hierarchical code organization.	L2	PO1, PO2, PO3, PO4, PO6, PO7
CO2	Work with textual information, characters and strings	L1	PO1, PO2, PO3, PO4, PO6, PO7
CO3	Implement file handling concepts	L2	PO1, PO2, PO3, PO4, PO6, PO7
CO4	Implement real time applications using the power of C language features.	L3	PO1, PO2, PO3,PO4,PO5 PO6, PO7
CO5	Overcome and solve possible errors during program execution	L2	PO1, PO2, PO3, PO4, PO6, PO7

B. Mapping matrix of CO, PO & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**
CO2	**2**	**3**	**3**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**
CO3	**3**	**2**	**2**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**
CO4	**2**	**1**	**1**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**
CO5	**3**	**1**	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**
Wt. AVG	2.6	1.8	1.8	2			2					

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-		
CO2	2	-	-		
CO3	3	-	-		
CO4	2	-	-		
CO5	1	-	-		
Wt. AVG	2.2				

LIST OF EXPERIMENTS

1	a) Given the values of the variables x, y and z, write a program to rotate their values such that x has the value of y, y has the value of z, and z has the value of x a) Write a program that reads a floating-point number and then displays the right-most digit of the integral part of the number.
2	a) Program to find largest and smallest number from four given numbers

	Program to find whether a year is leap or not
3	a) Write a C program in which enters any number by the user and perform the operation of Sum of digits of entered number. Write a C Program to convert Decimal number to Binary number
4	a) Find the sum of this series upto n terms 1+2+3+4+5+6+…….. b) Program to print Armstrong's numbers from 1 to 100 Write a program to convert years into Minute, Hours, Days, Months, Seconds using switch () statements
5	a) Write a C Program to print the reverse of an integer number b) Write a C program to check if the given Number is Prime or Not Write a C program to perform the factorial of given number
6	a) Write a C program to find maximum and minimum element in the Array b) Write a C program to Search the given element is in the Array or not (Linear Search) Write a C program to check if the given array is sorted or not
7	a) write a C program to perform Matrix addition and multiplication operations. Write a C Program to perform Transpose of a Matrix
8	a) Write a C Program to check if the given string is palindrome or not using Function b) Write a C Program to check if the given two strings are Anagram or not using Function Write a program to determine the length of the string and find its equivalent ASCII codes.
9	a) Write a C program to find nth Fibonacci number using Recursion Write a C Program to Find factorial of a number using Recursion
10	a) Write a C program to reverse an array using pointers and using Functions. (Dynamic Memory allocation for array) Write a C program to copy the contents of one array to another using pointers. (Dynamic Memory allocation for array)
Add-ons Experiments	
11	a) Write C Program to create a Book Structure and Pass this Book Structure as Argument to a function and print the total data in that function. a) Write C Program to create a Array of Books Structure and Pass this Book Structure as Argument to a function and return the book which has highest price.
12	a) Write a C program to open a text file and count the total number of lines, words, and characters. a) Write a C program that reads data from source.txt and copies it to destination.txt.

E. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Publication
1	Let us C	Yashwant Kanetkar	6th Edition
2	The C programming Language	Richie and Kenninghan	2nd Edition 2004
3	Programming in ANSI C	E Balaguruswamy	3rd Edition, 2005

Virtual Lab Link: https://www.vlab.co.in/

Code: BTXCCV1204 /2205 **Computer Aided Design (CADD)** **1 Credits [LTP: 0-0-2]**

COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Understand basic functions of commands, their techniques and fundamentals used in drafting and drawing.	L2	PO1, PO2
CO2	Demonstrate the fundamentals of commands through line diagram.	L2	PO1,PO2, PO3
CO3	Compare various shortcut keys and their different use case in drafting.	L4	PO1,PO2,PO3,PO4,PO5,PO6,PO7, PO9
CO4	Understand the fundamental principles of Blocks, Hatching, and texts of drawings.	L2	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12
CO5	Creating the layout of 2D plans in the workspace.	L6	PO1, PO2, PO3, PO4, PO5, PO6, PO7,PO8, PO9, PO10,PO11,PO12

B. Mapping matrix of CO, PO & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	3	1	1	1	3	1	2	-	1	-	-	-
CO4	3	3	2	3	3	2	2	2	2	1	1	1
CO5	3	3	3	3	3	3	3	3	2	2	2	2
Wt. AVG	3	2	2	2.3	3	2	2.3	2.5	1.6	1.5	1.5	1.5

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	-	-	-	-
CO2	1	-	-	-	-
CO3	1	-	-	-	-
CO4	1	-	-	-	-
CO5	1	-	-	-	-
Wt. AVG	1	-	-	-	-

D. LIST OF EXPERIMENTS

1	Introduction to AutoCAD and Drawing Tools Draw Different Shapes using Line, Polyline Circle, and Polygon.
2	Draw Different Shapes using Rectangle

	Use of Dimensions in Circle, rectangles, Line and other shapes.
3	Modify Drawings in AutoCAD using Modification Tools. Offset and Mirror Different Shapes and Lines.
4	Use Trim, Extend & Align, Scale and Stretch Command
5	Use of Text, Line, Block and Conversion Tools.
6	Introduction to Layers, How to add, Modify layers in layer manager.
7	Introduction of Hatch Command in AutoCAD
8	Opening and Modifying properties in AutoCAD
9	2D Plan of 1 BHK Residential Structure
10	2D Pine Flat Dam
	Add-ons Experiments
11	2D Sewerage Treatment Plant of Poornima University
12	Line Diagram of T shaped Building
	Virtual Lab
1	https://www.autodesk.in/campaigns/autocad-tutorials
2	https://web.autocad.com/login

Code: BTXCEE1205/ 2206 Electrical and Electronics Engineering Lab 1 Credits [LTP: 0-0-2]

COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	**At the end of this course, learners will able to:**	**Bloom level**	**PO Mapping**
CO1	Assemble and understand the operation of house wiring systems	L1	PO1, PO2,
CO2	Gain the ability to prepare and test connections for single-phase and three-phase induction motors using auto transformers	L2	PO1, PO2, PO3,
CO3	Develop the skills to connect and measure the electrical parameters (voltage, current, and power) of various lighting systems, such as fluorescent lamps, sodium vapor lamps, and halogen lamps.	L3	PO1, PO2, PO3
CO4	Proficient in identifying, testing, and applying various electronic components, such as resistors, conductors, capacitors, diodes , LEDs, LCDs, BJTs,	L2	PO1, PO2, PO3
CO5	Verify the truth tables of basic logic gates (AND, OR, NOT, NOR, NAND) and understand their applications.	L2	PO1, PO2, PO4

B. Mapping matrix of CO, PO & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-								
CO2	3	2	3	-								
CO3	3	2	3	-								
CO4	3	3	2	-								
CO5	3	2	2	2								
Wt. AVG	3	2.4	2.4	2								

LIST OF EXPERIMENTS

1	Assemble house wiring including earthing for 1-phase energy meter, MCB, ceiling fan, tube light, three pin socket and a lamp operated from two different positions. Basic functional study of components used in house wiring.
2	Prepare the connection of ceiling fan along with the regulator and vary the speed.
3	Prepare the connection of single phase induction motor through 1-Phase Auto-transformer and vary the speed.
4	Prepare the connection of three phase squirrel cage induction motor through 3-Phase Autotransformer and vary the speed.
5	Prepare the connection of Fluorescent Lamp, Sodium Vapour and Halogen Lamp and measure voltage, current and power in the circuit.
6	Identification, testing and application of Resistors, Inductors, Capacitors, PN-Diode. Zenger Diode, LED, LCD, BJT, Photo Diode, Photo Transistor, Analog/Digital Multi- Metres and Function/Signal Generator.
7	Measure the frequency, voltage, current with the help of CRO.

8	Assemble the single phase half wave and full wave bridge rectifier & the analyse effect of L, C and L-C filters in rectifiers.
9	Verify the truth table of AND, OR, NOT, NOR and NAND gates
10	Introduction to IOT. Printing of a Hello World on LCD Screen using Arduino
	Add-ons Experiments
11	Controlling the Light Emitting Diode (LED) with a push button and Interfacing of the Relay with Arduino.
12	Introduction to Raspberry Pi and Programming of available GPIO pins of the corresponding device using native programming language. Interfacing of I/O devices like LED/Switch etc., and testing the functionality.
	Virtual Lab
1	To perform Ohm's Law http://vlabs.iitkgp.ernet.in/be/exp4/index.html
2	Half Wave Rectification http://vlabs.iitkgp.ernet.in/be/exp6/index.html
3	VI Characteristics of Diode http://vlabs.iitkgp.ernet.in/be/exp5/index.html

Code: BTXCME1206 /2207	WORKSHOP PRACTICE	1 Credit [LTP: 0-1-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping
CO – 01	Prepare a model of T Lap and T- Briddle Joint through carpentry shop	L3	PO1, PO2, PO3
CO – 02	Understand the making of prototype model through foundry shop	L2	PO1,PO2,PO3
CO – 03	Understand the difference between gas welding and arc welding and their applications.	L2	PO1, PO2, PO3
CO – 04	prepare a model on fitting shop through filling, drilling and tapping operation	L3	PO1, PO2,PO3
CO – 05	Understand the difference between forging, moulding and casting	L2	PO1, PO2, PO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**3**	**2**	**1**	-	—	—	—	—	—	—	—	—
CO 2	**3**	**1**	**2**	-	—	—	—	—	—	—	—	—
CO 3	**3**	**2**	**1**	-	-	—	—	—	—	—	—	—
CO 4	**3**	**2**	**1**	-	-	—	—	—	—	—	—	—
CO 5	**3**	**2**	**1**	-	-	—	—	—	—	—	—	—
WT. AVG	**3**	**1.8**	**1.2**									

C. DETAILED SYLLABUS

1	**Carpentry Shop** • Timber, definition, engineering applications, seasoning and preservation • Plywood and ply boards
2	**Machine Shop** • Introduction to machine shop tools with emphasis on lathe machine operations. • Practical exercises on turning, facing, chamfering, and knurling of cylindrical components.
3	**Welding Shop** • Definition of welding, brazing and soldering processes and their applications • Oxyacetylene gas welding process, equipment and techniques, types of flames and their applications • Manual metal arc welding technique and equipment, AC and DC welding • Electrodes: Constituents and functions of electrode coating, welding positions • Types of welded joints, common welding defects such as cracks, undercutting, slag inclusion and boring
4	**Fitting Shop** • Files, materials and classification.
5	**Sheet metal shop** • Introduction to sheet metal tools, operations (cutting, bending, folding), and safety practices. • Hands-on fabrication of simple components like trays, boxes, and funnels using sheet metal techniques.
6	**Foundry Shop** • Moulding Sands, constituents and characteristics • Pattern, definition, materials types, core prints • Role of gate, runner, riser, core and chaplets • Causes and remedies of some common casting defects like blow holes, cavities, inclusions

Code: BTXCME1207/ 2208	Engineering Graphics Lab	1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping
CO – 01	Understand basic technical drawing concepts, including lines, lettering, dimensions, and scales, through the creation of sketches and drawings.	L2	PO2, PO4,PO5
CO – 02	Construct conic sections (ellipse, parabola, and hyperbola) on drawing sheets, showcasing practical application skills.	L3	PO4,PO5,
CO – 03	Apply knowledge of projection techniques to represent complex objects, such as regular polygons in different positions.	L3	PO1,PO3,PO4,PO5
CO – 04	Differentiate between types of projections, such as orthographic projections with first and third angle conventions. Proficiently project points, straight lines, and planes in different positions	L3	PO1, PO4
CO – 05	Analyze knowledge of sectional views and machine drawing techniques to communicate design and manufacturing details effectively	L3	PO1, PO4

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	**2**	-	**2**	**2**	—	—	—	—	—	—	—
CO 2	-	-	-	**3**	**2**	—	—	—	—	—	—	—
CO 3	**3**	-	**2**	**2**	**2**	—	—	—	—	—	—	—
CO 4	**3**	-	-	**2**	-	—	—	—	—	—	—	—
CO 5	**3**	-	-	**3**	-	—	—	—	—	—	—	—
WT. AVG	**3**	**2**	**2**	**2.5**	**2**							

C. LIST OF EXPERIMENTS

1.	● Lines, Lettering and Dimension (Sketch Book) ● Scales: Representative Fraction, plain scales, diagonal scales, (In drawing sheet 1)
2.	● Conic Sections: Construction of ellipse, parabola and hyperbola by different methods(in drawing sheet 2)
3.	● Type of Projection, Orthographic projection: first angle and third angle projection (in drawing sheet) ● Projection of Points ● Projection of Straight lines ● Projection of planes: Different positions of plane lamina like: regular polygon (four problems in drawing sheet 3)
4.	● Orthographic Projections (3 Problems in drawing sheet 4)
5.	● Sectional Views (2 Problems) and Riveted joints, lap joints, butt joints, (drawing sheet 5)

D. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1	Engineering Drawing	N. D. Bhatt	Latest	Charotar Publishing House PVT. LTD.
Virtual Lab				
1	https://kdm-iitkgp.vlabs.ac.in/exp/simple-drawing-board/theory.html			
2	https://cse18-iiith.vlabs.ac.in/			

E. RECOMMENDED STUDY MATERIAL

S. No.	Reference Book	Author	Edition	Publication
1	Engineering Drawing	N. D. Bhatt	Latest	Charotar Publishing House PVT. LTD.
Virtual Lab				
1	https://kdm-iitkgp.vlabs.ac.in/exp/simple-drawing-board/theory.html			
2	https://cse18-iiith.vlabs.ac.in/			

For FCE Students

Code: BTXCCE2103	Introduction to Web Technology	3 Credits [LTP:3-0-0]

A. Course Outcomes: -

CO	Cognitive Level	Course Outcomes
CO-1	Understand	Understand the fundamentals of internet technologies, protocols, and the client-server architecture to build a foundation for web development.
CO-2	Apply	Apply HTML and CSS concepts to create static web pages with structured layout and styling.
CO-3	Apply	Use JavaScript to implement interactivity and handle events through DOM manipulation and scripting logic.
CO-4	Analyze	Analyze and implement dynamic server-side functionality using PHP, including form handling, sessions, and cookies.
CO-5	Create	Design and deploy functional websites using modern deployment tools and platforms, and demonstrate practical knowledge of website management.

B. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to HTML And Internet	6
2.	HTML& CSS	9
3.	JAVASCRIPT	10
4.	PHP	7
5.	Practical web site development	7

C. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to HTML And Internet**
	• Introduction, History of internet, Internet Design Principles, Internet Protocols - FTP,TCP/IP, SMTP, Telnet, etc., Client Server Communication, Web System architecture • Evolution of the Web, Web architectures, Web clients and servers, Static and Dynamic Web Applications, Front end and back end web development. • HTML, CSS, JS, XML; HTTP, secure HTTP, etc; URL, Web Services – SOAP, REST • Conclusion of the Unit
2.	**HTML& CSS**
	• Introduction to Html, Html Document structure, Html Editors, Html element/tag & attributes, Designing simple page - Html tag, Head tag, Body tag; • More HTML Tags - Anchor tag, Image tag, Table tag, List tag, Frame tag, Div tag ; Html forms - Input type, Text area, Select , Button, Images. • New features, Local storage, Web Sockets, Server events, Canvas, Audio & Video, Geo location, Micro data, Drag and Drop • Introduction to CSS, Syntax, Selectors, Embedding CSS to Html, Formatting fonts, Text & background colour, Inline styles, External and Internal Style Sheets, Borders & boxing. • Conclusion of the Unit
3.	**JAVASCRIPT**

	• Introduction of the Unit • Features, syntax, and script integration methods (inline, internal, external) • Variables (var, let, const), data types, operators, Control structures (if, switch, loops), functions, and scope • DOM structure: nodes, elements & attributes, accessing elements: getElementById, querySelector, etc., Modifying content, style, and attributes dynamically • Common events (click, mouseover, keydown), Using addEventListener, preventing default actions, Event bubbling and delegation. • Conclusion of the Unit
4.	**PHP**
	• Introduction of the Unit • Role of PHP in server-side web development, Comparison with client-side scripting (JavaScript), Syntax and embedding PHP in HTML • Variables, data types, constants, and operators, Control structures: if, else, switch, loops, Functions and arrays • Overview of PHP superglobals: $_GET, $_POST, $_REQUEST, $_SERVER$_SESSION, $_COOKIE, $_FILES, $_ENV, $_GLOBALS • Dynamic content generation, Including external files (include, require), Using PHP to show form input, session info, etc. • Conclusion of the Unit
5.	**Practical web site development**
	• Introduction of the Unit • Commonly used Web Servers and browsers, Setting up a server and domain name, website types and structures, • Protocols used for web application deployment: • Deploy web application on : GitHub, Netlify, Vercel, Replit, Firebase etc. • Web authoring tools, Web hosting, website maintenance, generating traffic to your website. • Conclusion of the Unit

D. RECOMMENDED STUDY MATERIAL

S. No	**Text Books:**	**Author**	**Edition**	**Publication**
1.	Practical Web Design for Absolute Beginners	AdrianW. West	2016	Apress 2016
2.	Introducing Web Development	Jorg Krause	2017	Apress 2017
3.	HTML &CSS: The Complete Reference	Thomas Powell	2010	McGrawHill, Fifth Edition.
Reference Book				
1	HTML and CSS: Design and Build Websites – by Jon Duckett			
2.	Head First HTML and CSS: A Learner's Guide to Creating Standards-Based Web Pages – by Elisabeth Robson & Eric Freeman Publisher- ORELLY			
Online Resources				
1	https://www.w3schools.com/html/html_links.asp			
2	https://www.tutorialrepublic.com/html-tutorial/html-links.php			

E. CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	1	1	1	-	-	-	-	-	-	-	-	-	1	1	1	-
CO 2	2	2	1	-	-	-	-	-	-	-	-	-	2	2	1	-
CO 3	3	3	2	1	-	-	-	-	-	-	-	-	3	2	2	-
CO 4	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2	-
CO 5	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-

Code: BTXCCE2203	Introduction to Web Technology Lab	1Credits [LTP:0-0-1]

A. Course Outcomes: -

CO	Cognitive Abilities	Course Outcomes
CO – 01	Understand	To understand the core concepts of HTML, CSS, and client-server architecture in building static web pages.
CO – 02	Apply	To apply styling and layout techniques using CSS for designing visually appealing and responsive web pages.
CO – 03	Apply	To implement interactive features using JavaScript and validate user input on web forms.
CO – 04	Analyze	To analyze and develop dynamic web pages using PHP for server-side scripting and file handling.
CO – 05	Evaluate	To evaluate user interaction data and apply session tracking techniques in PHP for personalized web content.

B. List of Experiments: -

1	a. Create a web page using basic HTML features like tags, attributes, elements and page title b. How to install and configure a web server
2	a. Create My Profile Page and make it functional by making use of headings, paragraphs, lists, images and links. b. Enhance the above web page using CSS include the following: 1. Use different font styles. 2. Set back ground image for both the page and single elements on the page. 3. Control the repetition of image with back ground-repeat property. 4. Define style for links as a:link, b:active, c:hover, d:visited. 5. Add customized cursors for links.
3	Design an HTML form titled "Workshop Registration" using <form> tags as below: 
4	Create the following webpage: a. Show the class time table in a tabular format. b. Create a web page using HTML to show your geolocation.
5	Create a webpage using HTML for audio and video player.
6	Create a log in registration form and validate it using JavaScript.
7	a) Create a page with a <p> element and a <button>. When the button is clicked, change the paragraph text to "You clicked the button!". b) Create a button and a <p> element. Every time the button is clicked, increment and display a counter in the <p>. c) Create a page with a <button> labeled "Click Me". When clicked, it should display the current date and time in a using JavaScript and the click event.

8	a) Create an HTML page with an input field. On keydown, display the key pressed in a next to the input field. b) Create a dropdown (<select>) with color options (e.g., red, blue, green). Change the page background to the selected color on change. c) Create an image that changes to another image when hovered over, and reverts back when the mouse leaves. d) Create a Full To-Do List with Add, Done, Show Done, and Delete Functionality
9	Create a log in registration form using PHP.
10	Create a dynamic web page by using PHP conditional operators, loops and strings .
	Add-ons Experiments
11	Develop a PHP web application tracks the user as how many times visited and last visited time
12	Develop a static website using HTML, CSS & JavaScript

C. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1	Practical Web Design for Absolute Beginners	AdrianW. West	2016	Apress 2016
2	Introducing Web Development	Jorg Krause	2017	Apress2017
3	HTML & CSS: The Complete Reference	Thomas Powell	2010, Fifth Edition	McGrawHill,
Reference Book				
1	HTML and CSS: Design and Build Websites – by Jon Duckett			
2.	Head First HTML and CSS: A Learner‘s Guide to Creating Standards-Based Web Pages – by Elisabeth Robson & Eric Freeman Publisher- ORELLY			

D. CO-PO-PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	2	-	-	-	-	2	-	3	2	-	2	3
CO2	2	-	3	-	2	-	-	-	-	-	-	2	-	-	2	3
CO3	2	2	3	-	3	-	-	-	-	-	-	2	-	-	3	3
CO4	2	3	3	2	3	-	-	-	-	-	-	3	-	2	2	3
CO5	2	3	3	-	3	-	-	-	-	-	-	3	-	-	2	3

For FET Students

Code: BTXCCE1204 PROGRAMMING IN PYTHON 3 Credits [LTP:3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Understand the basic Python syntax, including data types, Keywords, Variables, and Identifiers.	L1	PO1,PO2,PO3
CO2	Demonstrate basic operators and understand the concept of Decision making, Conditional Statements and loops for problem solving	L2	PO1,PO2,PO3
CO3	Execute and use the concept of Lists, Tuple, Dictionaries, functions, and different python packages.	L3	PO1,PO2,PO5
CO4	Evaluate various object-oriented programming design principles to create structured python class and objects.	L4	PO1,PO2
CO5	Illustrate and Handle files in python which are raised during the execution of Python scripts	L4	PO1,PO3,PO12

B. Mapping matrix of CO & PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	1	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-		-	-	-	-	-
CO5	3	-	2	-	-	-	-	-	-	-	-	1
Wt. AVG	2.6	2.5	1.3		1							1

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	-	-
CO2	2	-	-	-	-
CO3	1	-	3	-	-
CO4	2	-	-	-	-
CO5	2	1	-	-	-
Wt. AVG	1.8	1	3		

D. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Introduction to Python Programming**	**7**
2.	**Python Operators and Control Flow statements**	**7**
3.	**Data Structures, Python Functions and Packages**	**7**
4.	**Object Oriented Programming**	**8**
5.	**File I/O Handling and Exception Handling**	**7**

E. DETAILED SYLLABUS

Unit	Unit Details
1	**Introduction to Python Programming**
	• Introduction to Unit • What is Python, • Uses of Python Programming Language / Python Applications • Features of Python Programming Language • Python-2 and Python-3 differences • Python environment setup — Installation and working of IDE • Running Simple Python scripts to display 'welcome' message. • Python Data Types: Numbers, String, Tuples, Lists, Dictionary. Python building blocks — Identifiers, Keywords, Indention, Variables, Comments • Conclusion of unit
2	**Python Operators and Control Flow statements**
	• Introduction to Unit • Basic Operators: Arithmetic, Comparison/ Relational, Assignment, Logical, Bitwise, Membership, Identity operators, Python Operator Precedence • Control Flow: • Conditional Statements (if, if ... else, nested if) • Looping in python (while loop, for loop, nested loops) • Conclusion of Unit
3	**Data Structures, Python Functions and Packages**
	• Introduction to Unit • Lists, Tuple, Sets • String and Slicing • Use of Python built • User defined functions and its types • Using standard packages (math, scipy, Numpy, pandas) • Conclusion of Unit
4	**Object Oriented Programming**
	• Introduction of Unit • Creating Classes and Objects • Inheritance • Method Overloading and Overriding • Data Hiding • Types of Methods : Instance Methods , Static Methods , Class Methods • Conclusion of Unit
5	**File I/O Handling and Exception Handling**
	• Introduction of Unit • Types of File • File Objects, File Built-in Function, File Built-in Methods • File Built-in Attributes • Read/write operations Reading Text • Errors in Python : Compile-Time Errors ,Runtime Errors , Logical Errors • Regular expressions • Conclusion of Unit

RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Publication
1	Core Python Programming	Chun, JWesley	Pearson,2007
2	Head First Python	Barry,Paul	Orielly,2010
3	Learning Python	Lutz, Mark	O Rielly, 2009

Code: BTXCCE2204	PROGRAMMING IN PYTHON LAB	1Credits [LTP:0-0-1]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Understand why Python is a useful scripting language for developers.	L2	PO1, PO2, PO3
CO2	Develop problem solving and critical thinking skills in fundamental enable techniques like conditionals and loops.	L3	PO1, PO2, PO3
CO3	Execute python program with concept of functions, List, Dictionary, structure, class & object.	L3	PO1, PO2, PO4
CO4	Integrate the key issues in Python code, develop and experiment with python programming.	L4	PO1, PO2, PO5
CO5	Linking read and write data from/to files in Python and Develop Python programs step-wise by defining functions with turtle.	L4	PO1, PO3, PO5

B. Mapping matrix of CO, PO & PSO

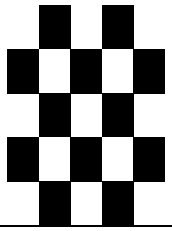
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-
CO3	2	3	-	1	-	-	-	-	-	-	-	-
CO4	3	2	-	-	1	-		-	-	-	-	-
CO5	3	-	2	-	1	-	-	-	-	-	-	-
Wt. AVG	2.6	2.5	1	1	1							

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	-	-
CO2	2	-	-	-	-
CO3	2	-	3	-	-
CO4	2	-	-	-	-
CO5	1	-	-	-	3
Wt. AVG	2		3		3

D. LIST OF EXPERIMENTS

1	a. Write a python program to check if the number is prime or not. b. Write a python program to find greatest of four numbers entered by user.
2	Write and run a Python program that asks the user for a temperature in Celsius and converts and output the temperature in Fahrenheit.
3	Write python program to perform following operations on Lists: a. Create list b. Access list c. Update list (Add item, Remove item) d. Delete list
4	Here is an algorithm to print out n! (n factorial) from 0! to 19!:

	1. Set f = 1 2. Set n = 0 3. Repeat the following 20 times: a. Output n, "! = ", f b. Add 1 to n c. Multiply f by n Using a for loop, write and run a Python program for this algorithm.
5	Modify the program above using a while loop so it prints out all of the factorial values that are less than 1 billion.
6	Write a python program to find the minimum in the array and find its index in the array.
7	Write a python program to implement bubble sort using function.
8	Write a python program to read 3 subject marks and display pass or failed using class and object.
9	Draw the Target symbol (a set of concentric Squares, alternating red and white) in a graphics window that is 200 pixels wide by 200 pixels high. Hint: Draw the largest circle first in red, then draw the next smaller circle in white, then draw the next smaller circle in red. Graphical objects drawn later appear "on top of" graphical objects drawn earlier.
10	Create a 5 X 5 rectangle whose top left corner is at (row*5, col*5). (Where is the bottom right corner?) If the sum of the row and col numbers is even, set the fill color of the rectangle to white, otherwise set it to black. Then draw the rectangle. 
	Virtual Lab/ Add-ons Experiments
1	Simulate python program to perform all Arithmetic Operations.
2	Simulate python program to analyze the concept of Constructor and Inheritance.
3	Simulate python program using Math, datetime, random and operator Module.

Professional Elective - I

Code: BTXECE2111	Introduction to Cloud Technology	2 Credits [LTP:2-0-0]

A. COURSE OUTCOMES: -

CO	Cognitive Abilities	Course Outcomes
CO – 01	Remember	Study importance of Cloud computing, various deployment and Service models.
CO – 02	Understand	Analyse three Layered Architectural Requirement of Cloud computing.
CO – 03	Apply	Study Comparative Analysis of Requirement at various layers.
CO – 04	Analyze	Understand various threats and security issues of cloud computing with solutions.
CO – 05	Evaluate	Study how virtualization improves performance and capacity of cloud services.

B. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Understanding cloud computing	**8**
2.	Cloud computing technology	**8**
3.	Fault Tolerance	**7**
4.	Security Management in Cloud	**7**
5.	Virtualization	**6**

C. DETAILED SYLLABUS

Unit	Unit Details
1.	**Understanding cloud computing**
	• Introduction to Cloud Computing • Benefits and Drawbacks - • History and Evolution of Cloud Computing, • Types of clouds, Private and Public clouds, • Cloud Computing architecture, • Cloud computing infrastructure, • Merits of Cloud computing, • Practical applications of cloud computing, • Cloud computing delivery models and services (IaaS, PaaS, SaaS) • Obstacles for cloud technology, Cloud vulnerabilities, Cloud challenges, • Conclusion of the Unit
2.	**Cloud Architecture Technology and Architectural Requirements**
	• The Business Case for Clouds • Hardware and Infrastructure • Accessing the cloud, Broad Approaches to Migrating into the Cloud, • The Seven-Step Model of Migration into a Cloud

	• Cloud Storage – Standards Software as a Service • Discovering Cloud Services Development tools • Three Layered Architectural Requirement • Provider Requirements • Service Centric Issues - Interoperability – QoS. • Conclusion of Unit
3.	**Fault Tolerance**
	• Fault Tolerance • Data Management Storage and Processing • Virtualization Management-Scalability • Load Balancing • Cloud Deployment for Enterprises • User Requirement • Comparative Analysis of Requirement. • Conclusion of Unit
4.	**Security Management in Cloud**
	• Security Management Standards • Security Management in the Cloud Availability Management • SaaS Availability Management - PaaS Availability Management – IaaS Availability Management • Access Control - Security Vulnerability, Patch, and Configuration Management – Privacy in Cloud • The Key Privacy Concerns in the Cloud - Security in Cloud Computing • Conclusion of Unit
5.	**Virtualization**
	• Introduction of Unit • Objectives - Benefits - Virtualization Technologies – • Data Storage Virtualization – Storage Virtualization • Improving Availability using Virtualization • Improving Performance using Virtualization • Conclusion of Unit

D. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Cloud Computing and SOA Convergence in your Enterprise A Step-by-Step Guide	David S Linthicum		Addison Wesley Information Technology Series
2.	Cloud Computing: Principles and Paradigms	Rajkumar Buyya, James Broberg, Andrzej M. Goscinski		John Wiley and Sons Publications, 2011
3.	Cloud Computing Theory and Practice	Dan C Marinescu, Elsevier		2013
Reference Book				
1.	Michael Miller, “Cloud Computing – Web-Based Applications that Change the Way You Work and Collaborate Online”, Pearson Education, New Delhi, 2009.			

2.	Cloud Computing Specialist Certification Kit – Virtualization Study Guide
Online Resources	
1.	https://www.geeksforgeeks.org/cloud-computing/
2.	https://aws.amazon.com/what-is-cloud-computing/

E. CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	**3**	**2**	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**
CO 2	**2**	**3**	**3**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO 3	**3**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**
CO 4	**2**	**1**	**1**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**
CO 5	**3**	**1**	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**

Code: BTXEME2112	Engineering Mechanics	2 Credits [LTP: 2-0-0]

A. COURSE OUTCOME

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping
CO – 01	Understand fundamental mechanics laws and principles to analyse systems of forces and moments accurately.	**L2**	PO1, PO2
CO – 02	Apply concepts of machine design and moment of inertia to optimize lifting machines and understand their mechanical behaviour.	L3	PO1, PO2, PO3, PO4
CO – 03	Analyse frictional effects in mechanical systems and optimize power transmission efficiency using belt drive principles.	L4	PO1, PO2, PO3, PO4
CO – 04	Evaluate particle and rigid body dynamics using kinematic and kinetic principles to predict system behaviour accurately.	L5	PO1, PO2, PO4
CO – 05	Evaluate work, power, and impact in mechanical systems, analysing collision impacts effectively using principles of energy conservation.	L5	PO1, PO2, PO4

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	2	-	-	-	-	-	-	-	-
CO 3	2	3	3	3	-	-	-	-	-	-	-	-
CO 4	2	3	-	3	-	-	-	-	-	-	-	-
CO 5	2	3	-	3	-	-	-	-	-	-	-	-
WT. AVG	2.2	3	3	2.75								

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	**Fundamentals of Mechanics**	**8**
2.	**Machine & Moment of Inertia**	**8**
3.	**Friction & Belt Drive**	**7**
4.	**Dynamics of Particles**	**8**
5.	**Work, Power & Impact**	**8**

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Fundamentals of Mechanics**
	• Introduction of Unit • Fundamental laws of mechanics, Principle of transmissibility. • System of forces, Resultant force, Resolution of force. • Introduction of Moment and Couples, Varignon’s Theorem Statement, Equilibrium concept, Lami's theorem Statement. Simple problems • Conclusion of Unit

2.	**Machine & Moment of Inertia**
	• Introduction of Unit • Lifting Machines: Mechanical advantage, Velocity Ratio, Efficiency of machine, Ideal machine, Ideal effort and ideal load, Law of machine. • Centroid & Moment of Inertia: Location of centroid and center of gravity, Moment of inertia, Introduction of Parallel axis and perpendicular axis theorem (Statement), M.I of composite section- I, T and L only. • Conclusion of Unit
3.	**Friction & Belt Drive**
	• Introduction of Unit • Friction: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Numerical on Ladder. • Belt Drive: Types of belts, Types of belt drives, Velocity ratio, Effect of slip on Velocity ratio, Ratio of tensions and power transmission by flat belt drives. Simple problems • Conclusion of Unit
4.	**Dynamics of Particles**
	• Introduction of Unit • Kinematics of Particles and Rigid Bodies: Velocity, Acceleration, Types of Motion, Equations of Motion, Rectangular components of velocity and acceleration. • Kinetics of Particles and Rigid Bodies: Newton's laws, Linear Momentum, Equation of motion in rectangular coordinate, D' Alembert principle. • Conclusion of Unit
5.	**Work, Power & Impact**
	• Introduction of Unit • Work, Energy and Power: Work of a force, weight, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy. • Impact: Collision of elastic bodies, types of impact, conservation of momentum, Newton's law of collision. • Conclusion of Unit

E. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1.	Vector Mechanics for Engineers	Beer and Johnston	Latest	Tata McGraw Hill
2.	Engineering Mechanics	D S Kumar	Latest	S K Kataria& Sons
3.	Engineering Mechanics Statics	Meriam, J. L. & Kraige, L. G	Latest	John Wiley & Son
4.	Engineering Mechanics	S. Ramamruthan	Latest	Dhanpat Rai Pub.
5.	Engineering Mechanics	Shames	Latest	Pearson Education
Important Web Links				
1.	https://nptel.ac.in/courses/112103109/			
2.	https://nptel.ac.in/courses/112106286/			
3.	https://freevideolectures.com/course/2264/engineering-mechanics			

Code: BTXECE2113	Introduction To Cyber Security	2 Credits [LTP:2-0-0]

ACOURSE OUTCOMES: -

CO	Cognitive Abilities	Course Outcomes
CO – 01	Remember	Recall the basic concepts of cyber security, common attacks, and key terminologies such as the CIA triad and attack vectors.
CO – 02	Understand	Explain the process of setting up a cybersecurity lab and the fundamental concepts of Linux, Windows, and Active Directory environments.
CO – 03	Apply	*Use networking knowledge to interpret how the web and common protocols function within cyber security contexts.*
CO – 04	Apply	Apply cryptographic techniques and tools to ensure data confidentiality, integrity, and authentication in secure communications.
CO – 05	Analyze	Analyze application vulnerabilities, security tools, and current trends like IoT and AI in cybersecurity for evaluating modern threat landscapes.

OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Cyber Security Fundamentals	7
2.	Lab Environment Setup & Operating System Basics	7
3.	Networking Security Essentials	7
4.	Cryptography and Data Protection	7
5.	Application Security, Tools & Emerging Trends	8

DETAILED SYLLABUS

Unit	Unit Details
1.	**Cyber Security Fundamentals**
	• Introduction to Unit • CIA Triad and Core Security Terminologies • Types of Cyber Threats and Attack Vectors • Common Cyber Attacks (e.g., Phishing, DDoS, MITM) • Overview of Offensive and Defensive Security • Careers and Certifications in Cyber Security • Conclusion of Unit
2.	**Lab Environment Setup & Operating System Basics**
	• Introduction to Unit • Setting up a Cyber Security Lab (VirtualBox/VMware, ISOs) • Linux Fundamentals and Linux Shell Basics • File System Permissions and User Management in Linux/Windows • Windows Fundamentals and PowerShell Basics • Introduction to Active Directory and Domain Concepts • Google Hacking Techniques and Search Operators • Conclusion of Unit
3.	**Networking Security Essentials**
	• Introduction to Unit • OSI Model and TCP/IP Model in Context of Cyber Security • Common Network Protocols Intro (TCP, UDP, ICMP, DNS, DHCP, etc.) • Network Services (SSH, FTP, SMB, NFS etc.) • How the Web Works (URL, DNS, Hosting, IP, Ports)

	• Deep Dive into HTTP and HTTPS for Web Security • Network Security Devices: Firewalls, IDS, IPS • VPNs and Encrypted Communication • Wireless Network Security and Network Segmentation
4.	**Cryptography and Data Protection**
	• Introduction to Unit • Basics of Cryptography and its Role in Cyber Security • Symmetric vs Asymmetric Encryption • Hashing Algorithms (MD5, SHA, etc.) • Digital Signatures and Message Authentication • Public Key Infrastructure (PKI) • Cryptographic Protocols (SSL/TLS, IPSec) • Password Cracking and Other Cryptography Tools Intro • Conclusion of Unit
5.	**Application Security, Tools & Emerging Trends**
	• Introduction to Unit • Common Web Vulnerabilities (OWASP Top 10, CVEs) • Key Tools Overview: • Burp Suite • Nmap • Metasploit • Hydra • Wireshark • Security Awareness & Social Engineering • Security Policies and Cyber Governance • Emerging Areas: IoT Security, Cloud Security, AI in Security • Conclusion of Unit

RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Computer security fundamentals (5th ed.)	Easttom, W.	1st , 2023	Pearson IT
2.	Introduction to Cyber Security	Jeetendra Pandey	1st Edition, 2017	Uttarakhand Open University,
Reference Book				
1.	Fundamental of Cyber Security Mayank Bhusan, Rajkumar Singh Rathore, Aatif Jamshed, (Principles, Theory and Practices) BPB Publications 2018.			
2.	Cyber Security Essentials, James Graham, Richard Howard, Ryan Olson, CRC Press			
Online Resources				
1.	https://tryhackme.com/path/outline/presecurity			
2.	https://tryhackme.com/path/outline/jrpenetrationtester			

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	2	-	-	-	-	-	-	-	-	-	1	3	-	-	-
CO 2	3	3	2	-	2	-	-	-	-	-	-	2	3	-	-	-

CO 3	3	3	-	-	2	-	-	-	-	-	-	2	3	2	-	-
CO 4	3	2	3	-	3	-	-	-	-	-	-	2	2	2	-	2
CO 5	3	3	2	2	2	-	-	-	-	-	-	3	2	-	-	2

Code: BTXECE2114	Introduction to Emerging Technology	2Credits[LTP:2-0-0]

A. Course Outcomes: -

CO	Cognitive Abilities	Course Outcomes
CO – 01	Understanding	Describe the evolution of industrial revolutions and the future trends in emerging technologies.
CO – 02	Applying	Explain the fundamentals of Data Science and its value chain, including data acquisition, storage, and visualization.
CO – 03	Analyzing	Analyze the applications of Artificial Intelligence and Internet of Things in sectors like education, business, and smart infrastructure.
CO – 04	Analyzing, Evaluating	Differentiate between AR, VR, and MR and examine their applications in various fields such as healthcare and education.
CO – 05	Evaluating, Creating	Evaluate various emerging technologies like blockchain, quantum computing, and additive manufacturing and discuss ethical issues related to cybersecurity and digital privacy.

B. CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	1	1	1	-	-	-	-	-	-	-	-	-	1	1	1	-
CO 2	2	2	1	-	-	-	-	-	-	-	-	-	2	2	1	-
CO 3	3	3	2	1	-	-	-	-	-	-	-	-	3	2	2	-
CO 4	3	3	3	2	-	-	-	-	-	-	-	-	3	3	2	-
CO 5	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3	-

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Evolution of Technologies	5
2.	Data Science	5
3.	Artificial Intelligence (AI) and Internet of Things (IoT)	5
4.	Augmented Reality (AR) and Virtual Reality (VR)	4
5.	Ethics in Technology and Other Emerging Technologies	5

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Evolution of Technologies**

	• Introduction of Unit • Includes Historical background of the industrial revolution, (IR1.0, IR2.0, IR3.0, IR.4.0 and IR5.0) • Role of data for emerging technologies • Human to Machine interaction, Cyber Physical Systems • Future trends in emerging technologies. • The Future of Work: Shifts Driven By Emerging Technologies • Conclusion &Real Life Application
2.	**Data Science**
	• Introduction of Unit • Overview of Data Science, Data and information, Data types and representation • Data Value Chain • Data Acquisition, Analysis, Curating, Data storage and big data. • Data visualization • Conclusion &Real Life Application
3.	**Artificial Intelligence (AI) and Internet of Things (IoT)**
	• Introduction of Unit • AI, Levels of AI, Types of AI, Application of AI in Business and Education • AI tools and platforms • Generative AI • Overview of IoT, working process of IoT, • Overview of IoT Architecture, • Application of IOT at Smart grid, smart city and smart farming. • Conclusion &Real Life Application
4.	**Augmented Reality (AR) and Virtual Reality (VR)**
	• Introduction of Unit • Introduction to AR, VR. • Augmented Reality Vs Mixed Reality (MR). • Architecture of AR systems. • Application of AR systems in Medical Assistance, Entertainment and Education. • Conclusion &Real Life Application
5.	**Ethics in Technology and Other Emerging Technologies**
	• Introduction of Unit • Block Chain Technology, • Cloud and quantum computing • Additive Manufacturing Technology • Flying Drones • Ethics, Digital Privacy and cyber security • Engineering Security and The Transition to Prosperity • Conclusion &Real Life Application

E. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Emerging Technology	Dr. Sanjay Sharma	Khanna Publishers	First Edition
2.	Emerging Technology for Engineers	Ms. Vasudha Tiwari, Dr. Sunil Kumar Chaudhary	Vayu Education Of India	First Edition
3.	IIBF X Taxmann's Emerging Technologies	Indian Institute of Banking & Finance	Taxmann Publications Private Limited	2024
Reference Book				

1	Emerging Exponential Technologies	Dr Deepak G Kulkarni, Dr. Prayag Gokhale	Himalaya Publishing House	2020
2	Introduction to Artificial Intelligence	Rajendra Akerkar	Eastern Economy Edition	2nd Edition
Online Resources				
1.	"An introduction to Data Science",Oxford Artificial Intelligence Society. https://www.careers.ox.ac.uk/files/datascienceinformationoxfordaisocietypdf			

Code: BTXECE2115	Introduction to Internet of Things	2 Credits [LTP: 2-0-0]

A. Course Outcomes: -

CO	Cognitive Abilities	Course Outcomes
CO – 01	Understand	Understand IoT architecture, characteristics, and evolution.
CO – 02	Apply	Apply knowledge of IoT hardware and communication models in real-time applications.
CO – 03	Analyze	Analyze IoT platforms and cloud technologies for effective data handling and analytics.
CO – 04	Create	Design and implement basic IoT systems using programming and sensor integration.
CO – 05	Evaluate	Evaluate IoT use cases in industry and address related security and privacy concerns.

B. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Internet of Things	6
2.	IoT Hardware and Communication	8
3.	IoT Platforms and Data Management	8
4.	IoT Programming and Interfacing	8
5.	IoT Applications and Security	7

C. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Internet of Things**
	● Introduction of Unit ● Definition, Characteristics, Applications ● History and Evolution of IoT ● 4/5-Layer Architecture ● Components of IoT: Sensors, Actuators, Embedded Systems ● RFID, Bluetooth, ZigBee, Wi-Fi, 4G/5G, Cloud Computing ● Security, Privacy, Interoperability ● Conclusion of the unit
2.	**IoT Hardware and Communication**
	● Introduction of Unit ● Arduino, Raspberry Pi, ESP8266, NodeMCU ● Request-Response, Publish-Subscribe ● Applicaction of Protocol:-MQTT, CoAP, HTTP, LoRa, ZigBee ● MAC, IP, TCP/UDP Layers, IPv6 ● Conclusion of the unit
3.	**IoT Platforms and Data Management**
	● Introduction of Unit ● AWS IoT, Google Cloud IoT, IBM Watson, Microsoft Azure ● Edge vs Cloud Computing ● NoSQL Databases for IoT (e.g., MongoDB) ● Basics of Data Analytics and Visualization ● Real-Time and Batch Processing

	• Conclusion of the Unit
4.	**IoT Programming and Interfacing**
	• Introduction of Unit • Python/C++ for IoT • Reading Sensor Data (Temperature, Humidity, etc.) • Controlling Actuators (LED, Motors) • Real-time data acquisition and control using IoT board • Use of APIs like OpenWeatherMap, ThingSpeak, Blynk • Conclusion of the Unit
5.	**IoT Applications and Security**
	• Introduction of Unit • Smart Homes, Smart Cities, Healthcare, Industrial IoT • Security Threats and Solutions • Encryption, Authentication, Secure Communication • Data Privacy, Ethical Use of IoT Data • Trends and Emerging Technologies (AIoT, Digital Twin) • Conclusion of the Unit

D. RECOMMENDED STUDY MATERIAL

S. No	Text Books:	Author	Edition	Publication
1.	Internet of Things: A Hands-On Approach	Arshdeep Bahga, Vijay Madisetti	1st Edition (2014)	Universities Press
2.	Internet of Things: Architecture and Design	Raj Kamal	2nd Edition (2021)	McGraw Hill Education
3.	Internet of Things: Principles and Paradigms	Rajkumar Buyya, Amir Vahid Dastjerd	1st Edition (2016)	Morgan Kaufmann (Elsevier)
Reference Book				
1.	The Internet of Things: Enabling Technologies, Platforms, and Use Cases by Pethuru Raj and Anupama C. Raman			
2.	Internet of Things by Jeeva Jose			
Online Resources				
1.	Introduction to Internet of Things (IoT) – Set 1 | GeeksforGeeks			
2.	Introduction to Internet of Things - Course			

E. CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	3	2	-	-	-	-	-	-	-	**2**	-	1	2	-	-	-
CO 2	3	2	2	-	-	-	-	-	-	-	-	1	3	2	-	-
CO 3	2	3	3	2	-	-	-	-	-	-	-	2	3	2	-	-
CO 4	2	2	3	-	-	-	-	-	-	-	-	1	3	3	-	-
CO 5	2	2	2	-	-	-	-	-	-	-	-	2	2	2	-	-

Code: BTXECE2116	Probability & Statistics for Data Analysis	2 Credits [LTP: 2-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Understand and apply measures of central tendency, dispersion, skewness, and kurtosis for basic statistical analysis.	L1	PO2, PO3, PO4, PO12
CO2	Apply statistical methods including correlation, regression, and curve fitting to interpret relationships between variables.	L3, L5	PO2, PO3, PO4, PO5
CO3	Demonstrate foundational knowledge of probability concepts and solve problems using probability rules and Bayes' Theorem	L2	PO2, PO3, PO4, PO5
CO4	Identify and analyze discrete and continuous probability distributions including Binomial, Poisson, Exponential, and Normal.	L4	PO2, PO3, PO4, PO5
CO5	Understand and apply sampling techniques, hypothesis testing, and chi-square test for making inferences from data.	L2	PO2, PO3, PO4, PO12

B. Mapping matrix of CO & PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	1	-	-	-	-	-	-	-	3
CO2	-	2	3	2	3	-	-	-	-	-	-	-
CO3	-	2	3	2	3	-	-	-	-	-	-	-
CO4	-	1	3	2	3	-	-	-	-	-	-	-
CO5	-	2	2	1	-	-	-	-	-	-	-	3
Wt. AVG		1.6	2.6	1.6	1.8							1.

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	3
CO2	-	-	-	-	3
CO3	-	-	-	-	3
CO4	-	-	-	-	3
CO5	-	-	-	-	3
Wt. AVG					3

D. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Basic Statistics**	**7**
2.	**Statistical Methods & Curve Fitting**	**8**
3.	**Probability**	**7**
4.	**Probability Distributions**	**7**
5.	**Sampling Theory**	**7**

E. DETAILED SYLLABUS

Unit	Unit Details
1	**Basic Statistics**

	• Introduction to Unit • Basic Statistics: Measures of central tendency, measures of dispersion, range quartile deviation, mean deviation, standard deviation, coefficient of variation, Skewness and Kurtosis, simple problems. • Conclusion of the Unit
2	**Statistical Methods & Curve Fitting**
	• Introduction of Unit • Statistical Methods: correlation and regression –Karl Pearson's coefficient of correlation and rank correlation problems, regression analysis-lines of regression, simple problems. • Curve fitting: curve fitting by the method of least square-fitting the curves of the form Y=ax+b, y=abx , y=ax2+bx+c • Conclusion of the Unit
3	**Probability**
	• Introduction of Unit • Introduction, sample space and events, • Axioms of probability, Addition and multiplication theorems, conditional probability, • Bayes' Theorem, simple problems. • Conclusion of the Unit
4	**Probability Distributions**
	• Introduction to Unit • Random variables (discrete and continuous), probability mass/density function • Binomial, Poisson, Exponential and normal distributions • Simple problems (no derivations for mean and standard deviation) • Conclusion of the Unit
5	**Sampling theory**
	• Introduction of Unit • Introduction to sampling distributions, • Standard error, type-I and type-II errors. • Test of hypothesis of means, students' distribution, • Chi-square distribution as a test of goodness of fit problems. • Conclusion of the Unit

F. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Publication
1.	Higher Engineering Mathematics	B. S. Grewal	Khanna publishers,44th Ed.2018
2.	An Introduction to Statistical Methods	C.B. Gupta	Vikas Publishing House Pvt Ltd; Twenty Third edition
3.	Introduction to Data Analytics	Eldhose P Sim	Notion Press

Code: BTXECE2117	Introduction to Artificial Intelligence	2 Credits [LTP: 2-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Remember how to identify systems with Artificial Intelligence. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.	L1	PO2, PO3, PO4, PO12
CO2	Apply appropriate search strategies to solve AI problems. Evaluate the efficiency and effectiveness of different search algorithms.	L3, L5	PO2, PO3, PO4, PO5
CO3	Understand the fundamentals of Constraint Satisfaction Problems (CSP). Explain the importance and applications of CSPs in AI.	L2	PO2, PO3, PO4, PO5
CO4	Analyze adversarial search in game playing and find out optimal solution using different algorithms. Analyzing Different types of games.	L4	PO2, PO3, PO4, PO5
CO5	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, Speech recognition and other machine learning models.	L2	PO2, PO3, PO4, PO12

B. Mapping matrix of CO & PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	1	-	-	-	-	-	-	-	3
CO2	-	2	3	2	3	-	-	-	-	-	-	-
CO3	-	2	3	2	3	-	-	-	-	-	-	-
CO4	-	1	3	2	3	-	-	-	-	-	-	-
CO5	-	2	2	1	-	-	-	-	-	-	-	3
Wt. AVG		1.6	2.6	1.6	1.8							1.

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	3
CO2	-	-	-	-	3
CO3	-	-	-	-	3
CO4	-	-	-	-	3
CO5	-	-	-	-	3
Wt. AVG					3

D. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	**Introduction to Artificial Intelligence**	**7**
2.	**Problem solving by Search**	**8**
3.	**Constraint Satisfaction Problems**	**7**

4.	**Adversarial Search and Game Playing**	**7**
5.	**AI Applications**	**7**

E. DETAILED SYLLABUS

Unit	Unit Details
1	**Introduction to Artificial Intelligence**
	● Introduction to Unit ● Definition of Artificial Intelligence ● Why do we study AI? What is AI? ● Views of AI: Acting Humanly, Thinking Humanly, Thinking Rationally and Acting Rationally ● Areas of AI, Agents and environments ● PEAS (Performance measure, Environment, Actuators, Sensors) ● Environment types ● Agent types: Simple reflex agents, Model-based reflex agents, Goal-based agents and Utility-based agents ● Examples of Agent ● Conclusion of the Unit
2	**Problem solving by Search**
	● Introduction of Unit ● Problem-solving agents, Problem formulation ● Example problems: 8-Puzzle problem and 8-queens problem ● Basic search algorithms ● Un-informed search strategies: Breadth-first search, Depth-first search, Depth-limited search, Uniform-cost search and ● Iterative deepening search ● Informed Search Algorithms: Best-first search, A* search, Hill-climbing search, and Genetic algorithms ● Conclusion of the Unit
3	**Constraint Satisfaction Problems**
	● Introduction to Constraint Satisfaction Problems (CSP) ● Why do we need to consider CSPs? ● Constraint Propagation ● CSP Vs Search problems ● Real-world CSPs, Finite vs. Infinite CSP ● CSP as a Search Problem: Backtracking search for CSPs, Forward checking for CSPs and Local search for CSPs ● Conclusion of the Unit
4	**Adversarial Search and Game Playing**
	● Introduction to Adversarial Search and Game Playing ● Games: Definition, Search vs. Games and Game Tree ● Optimal decisions in Games: Mini max algorithm and α-β pruning with example ● Imperfect, real-time decisions ● Partially Observable Games ● State-of-the-Art Game Programs: Chess on Deep Blue, Chess on standard PCs, Checkers on Chinook and Backgammon: TD-Gammon ● Conclusion of the Unit
5	**AI Applications**
	● Introduction of Unit ● Language Models ● Information Retrieval, Extraction ● Natural Language Processing ● Machine Translation, Speech Recognition ● Expert system: Introduction, phases, architecture, Expert system Vs Traditional system ● Robot, Hardware, Planning, Moving ● Conclusion of the Unit

F. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Publication
1.	Artificial Intelligence: A Modern Approach	S. Russell and P. Norvig	Prentice Hall
2.	Artificial Intelligence: A Systems Approach (Computer Science),	M. Tim Jones	Jones and Bartlett Publishers
3.	Prolog: Programming for Artificial Intelligence	I. Bratko	Addison-Wesley Educational Publishers Inc

Code: BTXECE2118	Front End Development	2 Credits [LTP: 2-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs)	At the end of this course, learners will able to:	Bloom level	PO Mapping
CO1	Develop dynamic and interactive web interfaces using JavaScript, DOM manipulation, and external libraries such as jQuery and jQuery UI.	L1	PO2, PO3, PO4, PO12
CO2	Demonstrate proficiency in TypeScript and ES6 features including classes, modules, promises, and transpilation techniques.	L3, L5	PO2, PO3, PO4, PO5
CO3	Build modular, scalable single-page applications (SPAs) using Angular with components, services, routing, and dependency injection.	L2	PO2, PO3, PO4, PO5
CO4	Create rich user interfaces using ReactJS by managing states, components, and performing CRUD operations with backend integration.	L4	PO2, PO3, PO4, PO5
CO5	Implement asynchronous web applications using Node.js, Express, and Promises for building responsive and real-time APIs.	L2	PO2, PO3, PO4, PO12

B. Mapping matrix of CO & PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	1	-	-	-	-	-	-	-	3
CO2	-	2	3	2	3	-	-	-	-	-	-	-
CO3	-	2	3	2	3	-	-	-	-	-	-	-
CO4	-	1	3	2	3	-	-	-	-	-	-	-
CO5	-	2	2	1	-	-	-	-	-	-	-	3
Wt. AVG		1.6	2.6	1.6	1.8							1.

C. Mapping matrix of CO & PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	3
CO2	-	-	-	-	3
CO3	-	-	-	-	3
CO4	-	-	-	-	3
CO5	-	-	-	-	3
Wt. AVG					3

D. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	JavaScript and jQuery	7
2.	TypeScript and ECMAScript (ES6)	8

3.	**Angular**	**7**
4.	**React JS**	**7**
5.	**Web APIs and Asynchronous Applications**	**7**

E. DETAILED SYLLABUS

Unit	Unit Details
1	**JavaScript and jQuery**
	● Introduction to Unit ● Understanding the DOM, ● DHTML and manipulating the HTML5 Document, ● Validating UI, ● Working with external JavaScript libraries like jQuery and jQueryUI ● Conclusion of the Unit
2	**TypeScript and ECMAScript (ES6)**
	● Introduction of Unit ● Understanding TypeScript and ECMAScript, ● Understanding Prototypes, ● Classes, Properties, Methods, Events, and Constructors, ● Scoping and Modules, ● Understanding and Working with Promise, ● Transpiling TypeScript ● Conclusion of the Unit
3	**Angular**
	● Introduction to Unit ● How Angular works, Angular Modules, Angular Components, ● Templates and Styles ● Routing, Observables, Components and Databinding, ● Services and Dependency Injection, ● Data binding the UI ● Conclusion of the Unit
4	**React JS**
	● Introduction to Unit ● How ReactJS works, ● JSX, React Components, ● Event Management, State Management, ● Data binding the UI and performing CRUD operations with the Web API using MongoDB, ● React Enriching the UX ● Conclusion of the Unit
5	**Web APIs and Asynchronous Applications**
	● Introduction of Unit ● Node & Express Environment, ● HTTP Requests & Routes-Handle requests to an Express with routes, ● Asynchronous JavaScript- Manage asynchronous JavaScript control flow with Promises ● Conclusion of the Unit

F. RECOMMENDED STUDY MATERIAL:

S. No	Reference Book	Author	Publication
1.	Full Stack Development with MongoDB	Manu Sharma	BPB Publications
2.	Front-End: Curso Completo de HTML, CSS e JavaScript	P A Gabrie	Tech Stuff House
3.	Front End Web Design and Development	Dr. Isha Gupta	Authorspress

Ability Enhancement Courses
Semester I

BEACHM1205	Applied English Communication- I	Credits: 1 (1-0-2)

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A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

CO No.	Course Outcome	Bloom's Taxonomy Level
CO1	Develop critical and creative thinking by solving hypothetical problems using limited resources.	**Create**
CO2	Exhibit persuasive communication and reasoning in debates and decision-making tasks.	**Evaluate**
CO3	Demonstrate collaboration and interpersonal skills through group-based storytelling and enactments.	**Apply**
CO4	Enhance public speaking confidence through extempore and stage-based activities.	**Apply**
CO5	Present innovative ideas and concepts effectively in front of an audience.	**Create**

B. OUTLINE OF THE COURSE

Unit No.	Unit Name	Hours
1	Collaborative Thinking and Problem-Solving Skills	3
2	Narration, Dialogue, and Group Presentation Skills	3
3	Formal and Impromptu Public Speaking	3
4	Functional and Contextual English Communication	3
5	Creativity, Ideation, and Visual Interpretation	3

C. DETAILED SYLLABUS

Unit	Unit Details
1	**Collaborative Thinking and Problem-Solving Skills**
	• Introduction to Unit • Team vs Wild – Scenario-based survival task emphasizing teamwork and critical thinking. • Who Gets the Heart? – Ethical dilemma debate for persuasive speaking and reasoning • Conclusion of the Unit
2	**Narration, Dialogue, and Group Presentation Skills**
	• Introduction of Unit • Debate – Structured argumentative speaking to enhance critical thinking and leadership. • Extempore – Impromptu individual speeches to build spontaneity and stage confidence • Theatrix – Paired roleplays to practice situational dialogues and collaborative speaking • Conclusion of the Unit
3	**Formal and Impromptu Public Speaking**
	• Introduction to Unit • Story Mason – Group storytelling for stage interaction and creativity. • Picture Connector – Visual storytelling by linking images to construct and narrate a cohesive idea • Insane Inventor – Solo presentation of imaginative products to foster innovation and clarity • Conclusion of the Unit
4	**Functional and Contextual English Communication**
	• Introduction to Unit • Shopping Roleplay – Day-to-day dialogue practice in a simulated shopping scenario. • Tourism Pitch – Team-based promotion of a location to enhance descriptive and persuasive communication.

	● Interpersonal Interaction Practice – Real-life communication drills for fluent and functional English usage ● Conclusion of the Unit
5	**Creativity, Ideation, and Visual Interpretation**
	● Introduction of Unit ● Picture connector: To make the students participate in group interactions, create dialogue and present on the stage. Students link various pictures from newspapers to come up with a pictorial representation of a story or idea and narrate/present the same. ● Creativity and presentation skills are concentrated. Students also learn to connect various variables and come up with concreate ideas" ● Insane Inventor: To make students present a creative idea or a product on stage. This is an individual task-based presentation session. This helps students instigate innovation and creative thinking along with presentation skills. ● Body Language and Professionalism Understanding body language helps students communicate more effectively and professionally. This skill enhances their ability to build trust, make positive impressions, and navigate workplace environments with confidence. ● Conclusion of the Unit

Semester II

BEACHM2212	QUANTITATIVE AND VERBAL APTITUDE TRAINING-I	Credits: 1 (1-0-2)

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes	Details of Course Outcomes	Bloom's Taxonomy Level
CO1	Understand concepts of number systems, percentages, and interest to solve quantitative problems.	Understand
CO2	Analyze data from tables, pie charts, and bar graphs to derive conclusions and evaluate the sufficiency of information.	Analyze
CO3	Demonstrate accuracy in solving logical reasoning problems involving arrangements, blood relations, and visual patterns.	Apply
CO4	Apply grammatical rules and sentence structures to identify and correct errors in English usage.	Apply
CO5	Develop effective reading, comprehension, and vocabulary skills to enhance verbal aptitude and communication.	Create

B. OUTLINE OF THE COURSE

UNIT NO.	UNIT NAME	HOURS
1	**Foundations of Quantitative Reasoning**	3
2	**Applied Arithmetic and Data Analysis**	3
3	**Logical and Analytical Reasoning**	3
4	**Verbal Mastery and Grammar Essentials**	3
5	**Reading, Vocabulary & Data Interpretation**	3

C. DETAILED SYLLABUS

Unit	Unit Details
1	**Foundations of Quantitative Reasoning**
	• Introduction to Unit • Number System – I Number system, Power cycle • Number System – II Remainder cycle, Factors, Multiples, HCF & LCM • Reading Comprehension: Speed Reading Strategies, RC types, Tackling Strategies • Conclusion of the Unit
2	**Applied Arithmetic and Data Analysis**
	• Introduction of Unit • Data Arrangement – I Linear and Circular Arrangements • Data Arrangement – II Multi-dimensional Arrangement, Blood Relations • Time and Work – I Work with efficiencies, Pipes and Cisterns • Conclusion of the Unit
3	**Logical and Analytical Reasoning**
	• Introduction to Unit • Time and Work – II Work equivalence, Division of wages • Sentence Correction – I Subject-Verb Agreement, Modifiers, Parallelism • Conclusion of the Unit
4	**Verbal Mastery and Grammar Essentials**
	• Introduction to Unit • Sentence Correction – IIPronoun Agreement, Verb Tenses, Comparisons • Sentence Correction – III Prepositions, Determiners • Conclusion of the Unit
5	**Reading, Vocabulary & Data Interpretation**
	• Introduction of Unit

	● Reasoning – I Coding-Decoding, Series ● Reasoning – II Analogy, Odd Man Out, Visual Reasoning ● Percentage & Interest – I Percentages, Percentage Change, S.I. ● Percentage & Interest – II C.I., Relation between S.I. and C.I. ● Verbal & DI Sentence Completion, Para-jumbles, Vocabulary, DI & DS ● Conclusion of the Unit

Skill Enhancement Courses

Semester I

BELCSE 1201	Skill Enhancement Course-I	Credits: 1 (1-0-2)

Course: Soft Skills 1

COURSE OUTCOMES: On completion of the course a student will be able to:

- Demonstrate effective communication skills through the use of appropriate body language, email etiquette, and impression management in academic and professional settings.
- Apply goal setting, habit formation, and time management strategies to enhance personal productivity and academic success.
- Collaborate efficiently in teams by understanding team dynamics, sharing responsibilities, and achieving common goals.
- Construct grammatically correct and contextually appropriate sentences using correct tenses, sentence structures, speech forms, and punctuation.
- Enhance language fluency and expression using idioms, phrasal verbs, collocations, gerunds, and infinitives in both written and spoken communication.

S. No.	Topic	Sub-Topics
1	Body Language and Professionalism	Understanding body language helps students communicate more effectively and professionally. This skill enhances their ability to build trust, make positive impressions, and navigate workplace environments with confidence.
2	Habit Formation	By understanding how habits are formed, students can create positive routines that boost productivity and success. This topic empowers them to adopt habits that support their personal and academic growth, while also learning how to break negative habits.
3	Goal Setting	Goal setting helps students stay focused and motivated. By teaching them to set clear, achievable goals, we ensure they have a roadmap for success, whether in their education, career, or personal life.
4	Impression Management	Impression management enables students to present themselves effectively in various social and professional settings. This skill is vital for building strong professional relationships, gaining trust, and achieving career success.
5	Team Building	Team building helps students understand the dynamics of effective collaboration. This topic teaches them how to work together, share responsibilities, and achieve common goals, which are essential skills in almost every workplace.
6	Time Management	Time management skills are essential for students to balance academic workloads, personal life, and professional responsibilities. By teaching them how to prioritize tasks and manage their time effectively, we help them reduce stress and increase productivity.
7	Email Writing	Helps participants write clear and professional emails with the right tone and structure. Covers greetings, body, closings, and common errors to avoid. Includes real-life practice for confident workplace communication.
8	Classification of sentences	Learning different types of sentence and their application help one to choose appropriate sentence for appropriate function.
9	Tenses	Tense is the skeleton of English language and proper usage of tense forms ensures proper meaning conveyed.

10	Forms and Speech and Voice	Use of direct and indirect speech is essential for speaking ability in English. Voices help in writing convincing and diplomatic sentence/paragraphs.
11	Idioms and Phrasal Verbs	Idioms add flavour and richness to the English language. The author/speakers will sound savvy if idioms and phrasal verbs are appropriately used.
12	Collocations, Gerund and Infinitives	Company of words are called collocations and proper use of collocations brings finesse in one's language. Gerund and infinitives usage helps fine-tune one's language.
13	Punctuations	Improper punctuations in written scripts convey meanings different than the intended one. Writing ability is greatly enhanced by proper usage of punctuations.

Semester II

BELCSE 2201	Skill Enhancement Course-II	Credits: 1 (1-0-2)

Course: Fundamental of Programming

COURSE OUTCOMES: On completion of the course a student will be able to:

- Demonstrate basic input and output operations using formatted printing and user input methods.
- Apply various operators to perform arithmetic, relational, logical, and bitwise operations in programs.
- Implement conditional logic using if-else, nested conditions, and switch-case constructs.
- Develop iterative solutions using loops such as for, while, and do-while, along with loop control statements.
- Generate mathematical sequences like Fibonacci, arithmetic, and geometric series using programming logic.

S. No.	Topic	Sub-Topics
1	**Input & Output**	**System.out.println():** Used to display output on the console. Allows formatted output with printf() or format(). **Practical Exercise:** Write a program to print a personalized greeting message using System.out.println(). **Scanner class:** Reads user input from the console. Supports methods like nextInt(), nextDouble(), nextLine() for different data types. **Practical Exercise:** Write a program to take two numbers as input from the user and display their sum.
2	**Operators**	**Arithmetic operators:** Perform basic mathematical operations like addition, subtraction, multiplication, division, modulus, exponentiation, and floor division. **Relational operators:** Compare values and return Boolean results like greater than, less than, equal to, or not equal. **Logical operators:** Combine multiple conditions using logical connectors like AND, OR, and NOT. **Assignment operators:** Assign values to variables and combine them with arithmetic or logical operations. **Bitwise operators:** Perform operations at the binary level, manipulating individual bits in integers. **Practical Exercise:** Create a program to find to all the operators
3	**Operators**	**Arithmetic operators:** Perform basic mathematical operations like addition, subtraction, multiplication, division, modulus, exponentiation, and floor division. **Relational operators:** Compare values and return Boolean results like greater than, less than, equal to, or not equal. **Logical operators:** Combine multiple conditions using logical connectors like AND, OR, and NOT. **Assignment operators:** Assign values to variables and combine them with arithmetic or logical operations. **Bitwise operators:** Perform operations at the binary level, manipulating individual bits in integers. **Practical Exercise:** Create a program to find to all the operators
4	**Decision Making**	**if, elif, else statements:** Control the program flow based on conditions. Execute specific blocks of code depending on whether conditions are met. **Practical Exercise:** Write a program to determine if a number is positive, negative, or zero. **Nested conditions:** Allow the inclusion of an if statement inside another if to test complex logic. **Practical Exercise:** Create a program to check if a number is divisible by both 2 and 3.

		switch-case: Selects among multiple options based on the value of an expression. **Practical Exercise:** Create a program that accepts a number (1-7) and prints the corresponding day of the week.
5	**Decision Making**	**if, elif, else statements:** Control the program flow based on conditions. Execute specific blocks of code depending on whether conditions are met. **Practical Exercise:** Write a program to determine if a number is positive, negative, or zero. **Nested conditions:** Allow the inclusion of an if statement inside another if to test complex logic. **Practical Exercise:** Create a program to check if a number is divisible by both 2 and 3. **switch-case:** Selects among multiple options based on the value of an expression. **Practical Exercise:** Create a program that accepts a number (1-7) and prints the corresponding day of the week.
6	**Decision Making**	**if, elif, else statements:** Control the program flow based on conditions. Execute specific blocks of code depending on whether conditions are met. **Practical Exercise:** Write a program to determine if a number is positive, negative, or zero. **Nested conditions:** Allow the inclusion of an if statement inside another if to test complex logic. **Practical Exercise:** Create a program to check if a number is divisible by both 2 and 3. **switch-case:** Selects among multiple options based on the value of an expression. **Practical Exercise:** Create a program that accepts a number (1-7) and prints the corresponding day of the week.
7	**Looping**	**for loop:** Used to iterate over sequences like ranges, lists, or strings, executing a block of code for each element. **Practical Exercise:** Write a program to print the squares of numbers from 1 to 10. **while loop:** Executes a block of code as long as the condition is true, often used when the number of iterations is unknown. **Practical Exercise:** Write a program to find the sum of natural numbers up to a given limit using a while loop. **do-while loop:** Similar to while, but guarantees at least one iteration. **Practical Exercise:** Create a program to repeatedly ask the user for input until a valid number is provided. **Loop control statements:** break stops the loop, continue skips the current iteration, and pass is a placeholder for future code without affecting execution. **Practical Exercise:** Demonstrate the use of break to exit a loop when a condition is met.
8	**Looping**	**for loop:** Used to iterate over sequences like ranges, lists, or strings, executing a block of code for each element. **Practical Exercise:** Write a program to print the squares of numbers from 1 to 10. **while loop:** Executes a block of code as long as the condition is true, often used when the number of iterations is unknown. **Practical Exercise:** Write a program to find the sum of natural numbers up to a given limit using a while loop. **do-while loop:** Similar to while, but guarantees at least one iteration. **Practical Exercise:** Create a program to repeatedly ask the user for input until a valid number is provided. **Loop control statements:** break stops the loop, continue skips the current iteration, and pass is a placeholder for future code without affecting execution. **Practical Exercise:** Demonstrate the use of break to exit a loop when a condition is met.

9	**Looping**	**for loop:** Used to iterate over sequences like ranges, lists, or strings, executing a block of code for each element. **Practical Exercise:** Write a program to print the squares of numbers from 1 to 10. **while loop:** Executes a block of code as long as the condition is true, often used when the number of iterations is unknown. **Practical Exercise:** Write a program to find the sum of natural numbers up to a given limit using a while loop. **do-while loop:** Similar to while, but guarantees at least one iteration. **Practical Exercise:** Create a program to repeatedly ask the user for input until a valid number is provided. **Loop control statements:** break stops the loop, continue skips the current iteration, and pass is a placeholder for future code without affecting execution. **Practical Exercise:** Demonstrate the use of break to exit a loop when a condition is met.
10	**Series Programming**	**Series Programming:** It involves generating various types of sequences like arithmetic, geometric, Fibonacci, etc. These series are useful in mathematics and algorithm design. **Practical Exercise:** Write a program to generate the Fibonacci series up to n terms. **Arithmetic and Geometric Series:** The arithmetic series involves generating numbers by adding a constant difference to the previous term. The nth term is given by Tn = a + (n-1) * d. A geometric series is a sequence where each term is found by multiplying the previous term by a constant ratio r. The nth term is Tn = a * r^(n-1), where a is the first term and r is the common ratio. The sum of the first n terms is S = a * (1 - r^n) / (1 - r). This series often appears in financial calculations such as compound interest. **Practical Exercise:** Write a program to generate the first n terms of an arithmetic and geometric series.
11	**Series Programming**	**Series Programming:** It involves generating various types of sequences like arithmetic, geometric, Fibonacci, etc. These series are useful in mathematics and algorithm design. **Practical Exercise:** Write a program to generate the Fibonacci series up to n terms. **Arithmetic and Geometric Series:** The arithmetic series involves generating numbers by adding a constant difference to the previous term. The nth term is given by Tn = a + (n-1) * d. A geometric series is a sequence where each term is found by multiplying the previous term by a constant ratio r. The nth term is Tn = a * r^(n-1), where a is the first term and r is the common ratio. The sum of the first n terms is S = a * (1 - r^n) / (1 - r). This series often appears in financial calculations such as compound interest. **Practical Exercise:** Write a program to generate the first n terms of an arithmetic and geometric series.
12	**Pattern Programming**	**Star Pattern:** Pattern programming involves printing specific patterns (e.g., stars, numbers) arranged in different shapes like triangles, squares, pyramids, etc. These patterns help practice loops and conditional statements. **Practical Exercise:** Write a program to print the following pyramid of stars: * *** ***** **Number and Alphabet Pattern:** In number patterns, numbers are arranged in specific sequences, often following simple rules. Examples include printing numbers in ascending or descending order in different shapes. **Practical Exercise:** Write a program to print a number triangle pattern like: 1 1 2 1 2 3

Value Added Courses (VAC)

Code: BUVCVD1202/ 2202	Exploratory Project	1 Credits [LTP: 0-0-2]

LAB OUTCOMES: After Successful completion of the lab students will be able to-

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping
CO – 01	Predict a problem of current relevance to society using research and analytical skills.	L2	PO1, PO2, PO3, PO6, PO7, PO9, PO10, PO12
CO – 02	Formulate the problem and identify suitable modeling paradigms through collaborative discussions and research.	L3	PO1,PO2,PO3, PO4, PO6, PO7, PO9, PO10, PO11, PO12
CO – 03	Categorize the problem and identify the solution methodology using systematic problem-solving techniques.	L3	PO1, PO2, PO3, PO4, PO6, PO7, PO9, PO10, PO11, PO12
CO – 04	Simulate and design systems using various modern tools and software applications.	L4	PO1, PO2,PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12
CO – 05	Validate the results and prepare a comprehensive project report.	L4	PO1, PO2,PO3, PO4, PO5, PO6, PO7, PO9, PO10, PO11, PO12

MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	**3**	**3**	**1**	-	—	**2**	**1**	—	**1**	**1**	—	**2**
CO 2	**3**	**3**	**3**	**2**	—	**2**	**2**	—	**2**	**2**	**1**	**2**
CO 3	**3**	**3**	**2**	**2**	-	**2**	**2**	—	**2**	**2**	**1**	**2**
CO 4	**3**	**3**	**3**	**2**	**3**	**2**	**2**	—	**3**	**3**	**2**	**3**
CO 5	**3**	**3**	**3**	**3**	**3**	**2**	**2**	—	**3**	**3**	**2**	**3**
WT. AVG	**3**	**3**	**2.4**	**2.25**	**3**	**2**	**1.8**	-	**2.2**	**2.2**	**1.5**	**2.4**

GUIDELINES:

1. The Project group must complete project in all respect (assembly, testing, fabrication, tabulation, test result etc.)
2. The group should maintain a log book of activities. It should have entries related to the worked one, problems faced, solution evolved etc., duly signed by guide.
3. The guides should regularly monitor the progress of the project work.
4. The project work along with project report should be submitted as part of term work in first term on or before the last day of the second term.
5. Project report must be submitted in the prescribed format only. No variation in the format will be accepted.
6. Assessment of the project forward of marks shall be done by the guide and a departmental committee.
7. The guide should be internal examiner for oral examination.
8. The external examiner should be from the related area of the concerned project. He should have experience at degree level / industry.

The evaluation at final oral examination should be done jointly by the internal and external examiner.

Phases:

Project work is divided into the following phases:

Phase I

- Allocation of groups(Max. 4 Members & Min. 2 Members) & guide
- Black board presentation on topics as per the choice & feasibility
- Submission of abstract & synopsis of the project

Phase II

- Procurement of the components
- 2D/3D figure or model
- Paper work like any circuit diagram and tentative cost

Phase III

- Working Model of the project
- Mounting the components
- Final hardware evaluation/presentation
- Submission of the final hardware to the coordinator.

Phase V

- Final report submission (after project exhibition)
- Paper presentation on the selected project in seminars /conferences/journals
- Viva voce

Deadlines of Phases:

The Project will be covered in 13 weeks from starting of semester. The time allocated to each phase is as follow:

Phase -1: Maximum 2 weeks
Phase -2: Maximum 3 weeks
Phase -3: Maximum 6 weeks
Phase- 4: Maximum 2 weeks

Distribution of Marks:-

Total Marks 100

Break up of marks (100)

Performance of Phase 1	:15
Performance of Phase 2	:20
Performance of Phase 3	:20
Performance of Phase 4	:45
Total	:**100**

Note: 1. Performance marks of Phase 1/2/3/4 will be given by Coordinators, Guide and external (if any) on completion of the respective phase.

2. Presentation and demonstration will be taken by Project Coordinator, Guide.

3. Guide feedback will be collected by Project Coordinator.

Code: BUVCVH1201/ 2201 Universal Human Values and Professional Ethics Lab 1 Credits [LTP: 0-0-2]

COURSE OUTCOMES:

The student would be able to:
CO1: Identify what is valuable to human beings and what are the aspirations of life.
CO2: Apply the understanding of value education in solving various problems.
CO3: Observe and examine the issues related to harmony in self, society, and nature.
CO4: Focus on physical and mental fitness.
CO5: Apply the knowledge to their own self and in day-to-day life.

LIST OF ACTIVITIES

1	Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your salient achievements and shortcomings in your life? Observe and analyze them.
2	Now-a-days, there is a lot of talk about many techno-genic maladies such as energy and material resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmade problems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opinion? On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats to human happiness and peace - what could be the way out in your opinion?
3	Observe that each of us has the faculty of „Natural Acceptance", based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our „Natural Acceptance" and may a time it is also clouded by our strong pre-conditioning and sensory attractions). Explore the following: What is Naturally Acceptable" to you in a relationship the feeling of respect or disrespect for yourself and for others? What is „naturally Acceptable" to you - to nurture or to exploit others? Is your living in accordance with your natural acceptance or different from it? 2. Out of the three basic requirements for fulfillment of your aspirations - right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also, observe how much time & effort you devote to each in your daily routine.
4	1. a. Observe that any physical facility you use, follows the given sequence with time: Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment! 2. List down all your important activities. Observe whether the activity is of „I" or of Body or with the participation of both or with the participation of both „I" and Body. Observe the activities within „i". Identify the object of your attention for different momentss (over a period of say 5 to 10 minutes) and draw a line diagram connecting these points. Try to observe the link between any two nodes.
5	1. Write a narration in the form of a story, poem, skit, or essay to clarify a salient Human Value to the children. 2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to values in a difficult situation.
6	List down some common units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each unit with other orders.
7	Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values? If so, how should one proceed in this direction from the present situation?
8	1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order. 2. Propose a broad outline for humanistic Constitution at the level of Nation.

	Project: Every student required to take-up a social project e.g. educating children in needy/weaker section; services in hospitals, NGO's and other such work i.e. social work at villages adopted by respective institute/ college.

Code: BUVCVD1201/ 2201	Entrepreneurship	1 Credits [LTP: 0-0-2]

COURSE OUTCOMES

- Understand the role of entrepreneurship and assess entrepreneurial traits for personal development
- Demonstrate teamwork, leadership, creative thinking, and problem-solving skills in entrepreneurial contexts
- Identify and evaluate entrepreneurial opportunities through fieldwork and feasibility analysis.
- Develop and articulate business models, value propositions, and branding strategies for startup ideas.
- Pitch startup concepts confidently and test prototypes through practical simulations and presentations.

DETAILED SYLLABUS

S. No.	Activity
1	Discovering Entrepreneurship *(Roleplay + Reflection) - Understand who an entrepreneur is, explore the relevance of entrepreneurship in daily life and India's economy.*
2	Entrepreneurial Traits Self-Assessment *(Psychometric test + Peer discussion)* - Reflect on one's own entrepreneurial potential and learn about key traits such as risk-taking, innovation, and leadership.
3	Team Building and Leadership Game *(Marshmallow Challenge / Tower Building)*- Experience real-time leadership, communication, and team dynamics.
4	Creative Thinking & Problem Solving *(SCAMPER Technique, Brainwriting)* - Apply creativity tools to real-life problems and generate startup-worthy ideas.
5	Opportunity Hunting on Campus/Community *(Field task + analysis) - Identify unmet needs around them and frame them as entrepreneurial opportunities.*
6	Feasibility Check – Market & Tech *(Customer interviews, internet research) - Evaluate technical and market feasibility of selected ideas.*
7	Value Proposition Canvas *(Hands-on worksheet)* - Learn how to define pain points, gains, and value offering for a chosen idea.
8	Business Model Canvas *(Build BMC for idea in teams)* - Draft one-page startup blueprint covering key segments.
9	Elevator Pitch – 60 Seconds to Win *(Practice in class + peer feedback)* - Develop confidence and clarity in articulating startup ideas.
10	Startup Branding and Naming Workshop *(Design logo/tagline using Canva/Figma)* - Understand basics of startup identity, naming, logo creation, and storytelling.
	Add-ons
11	Mini Campus Startup Fair *(1-day sales/prototype simulation)* - Create and test MVP/prototype through sales or demo booths within campus.
12	Final Pitch + Learning Showcase *(Team presentation + reflection journal)* - Summarize the journey, pitch refined startup idea, and reflect on growth and learning.

THIRD SEMESTER

Code: BMECSA3101	ENGINEERING MATHEMATICS - II	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES:

Course Outcomes (CO):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	Demonstrate an understanding of the specific forms of non-linear differential equations, including those that do not directly contain x or y.	L2	PO1, PO2	**PSO1**
CO2	Analyze the effectiveness of using partial fractions to find inverse Laplace transforms and their inverses to solve differential equations and analyze their solutions	L4	PO1, PO2, PO4	**PSO1**
CO3	Apply Fourier transforms to solve problems involving partial differential equations in various fields and the advantages and limitations of using Fourier transforms compared to other methods in solving differential equations.	L3	PO1, PO2, PO3	**PSO1**
CO4	Apply numerical differentiation and integration techniques, such as the trapezoidal rule and Simpson's rules, to approximate solutions to mathematical problems.	L3	PO1, PO2, PO3	**PSO1**
CO5	Analyze different probability distributions, such as binomial, Poisson, and normal distributions, and their characteristics.	L4	PO1, PO2, PO4	**PSO1**

B. MAPPING MATRIX OF CO, PO & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	3	-	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	1	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	-	1	-	-	-	-	-	-	-	-	2	-	-
WT. AVG	2.4	2.4	1.5	1									1.6		

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Ordinary Differential Equations	7
2.	Laplace Transform	9
3.	Fourier Transform	9
4.	Numerical Methods	9S
5.	Statistics and Probability	8

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Ordinary Differential Equations**
	• Introduction of Unit. • Exact Linear Differential Equations of 2nd order • Nonlinear differential equation of particular form: Equation of the form $d^n y/dx^n = f(x)$ (Introduction Only) • Equation that does not contain x directly. • Equation that does not contain y directly. • Conclusion and Summary of Unit**.**
0.	**Laplace Transform**
	• Introduction of Unit. • Laplace Transform: Advantage and sufficient conditions for existence of Laplace Transform, General Properties of Laplace Transform. • Inverse Laplace Transform, General Properties of Inverse Laplace Transform, Use of partial fractions to find Inverse Laplace Transform. • Solution of Ordinary differential equation with constant coefficients. • Conclusion and Summary of Unit.
0.	**Fourier Transform**
	• Introduction of Unit • Fourier Integral theorem, Fourier Sine & Cosine Integrals. • Fourier Transforms, Fourier Cosine Transforms, Fourier Sine Transform and their inverse. • Application of Fourier Transform in solving Partial Differential Equations • Conclusion and Summary of Unit.
1.	**Numerical Methods**
	• Introduction of the Unit • Numerical differentiation simple methods, • Numerical integration: Derivation of General Quadrature formulas, • Trapezoidal rule, Simpson's one third and Simpson's three eighth rule • Conclusion and Summary of Unit.
0.	**Statistics and Probability**
	• Introduction of Unit • Statistics, Introduction to Mean, Median, Mode, Standard deviation, Variance, Coefficient of variation • Probability, Probability distribution functions, Binomial, Poisson, Normal Distribution • Conclusion and Summary of Unit.

E. RECOMMENDED STUDY MATERIAL:

S. No	Book	Author	Edition	Publication
a. Reference Books				
1.	Higher Engineering Mathematics	B S Grewal	Latest	Khanna Publications, Delhi,
2.	Higher Engineering Mathematics	Ramana, B. V	Latest	TMH
3.	Engineering Mathematics: A Tutorial Approach	Ravish R Singh and M Bhatt	Latest	TMH
4.	Calculus and Analytical Geometry	Thomas and Finney,	Latest	Narosa Publishing, Delhi
5.	Advanced Engineering Mathematics	Erwin Kreyszig	Latest	John Wiley and Sons
b. Important Web Links:				
1.	https://nptel.ac.in/courses/111105035/			
2.	https://nptel.ac.in/courses/111105121/			

Code: BMECME3102	MECHANICS OF SOLIDS	3 Credits [LTP: 3-1-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Demonstrate stress and strain concepts, including linear, lateral, shear, and volumetric deformations.	L1	PO1, PO2, PO3	PSO2
CO – 02	Understand the concepts of principle plan of axial forces and theory of failure.	L2	PO1, PO2, PO3	PSO2
CO – 03	Calculate shear force and bending moment diagram of different beam.	L3	PO1, PO2, PO3	PSO2
CO – 04	Understand the concept of torsion of shaft and buckling of column	L2	PO1, PO2, PO3,	PSO2
CO – 05	Calculate slope and deflection in beam using different method.	L3	PO1, PO2, PO3	PSO2

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**1**	**2**	-	—	—	—	—	—	—	—	—	-	**2**	-
CO 2	**3**	**2**	**1**	-	—	—	—	—	—	—	—	—	—	**3**	-
CO 3	**3**	**3**	**1**	-	—	—	—	—	—	—	—	—	—	**3**	-
CO 4	**3**	**1**	**2**	-	-	—	—	—	—	—	—	—	—	**3**	-
CO 5	**3**	**3**	**1**	-	—	—	—	—	—	—	—	—	—	**3**	-
WT. AVG	**3**	**2**	**1.4**											**2.8**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Simple Stresses & Strains	7
2	Principle Stresses & Theory of Failure	7
3	Shear Force and Bending Moment Diagram	7
4	Torsion in Circular Shafts	7
5	Deflection of Beams and Strain Energy	8

D. DETAILED SYLLABUS

Unit	Unit Details
1	**Simple Stresses & Strains**
	● Introduction of Unit ● Concept of stress and strain (linear, lateral, shear and volumetric), Hook'slaw, Poisson'sratio, modulus of elasticity, modulus of rigidity, stress-strain diagram for ductile and brittle materials, factor of safety and working stress, bulk modulus, inter relation between elastic modulus. Various strengths of material- Yield strength, Ultimate permissible stress. ● Axial force diagram, stress-strain, deformations in determinate homogeneous and composite bars of following types. 1) Prismatic 2) Linearly varying 3) stepped section under concentrated loads and self-weights. Stress due to temperature change in composite bar, Deformation under self-weight. ● Conclusion and Summary of Unit
2	**Principle Stresses & Theory of Failure**
	● Introduction of Unit ● Principal planes, stresses & strains; Normal and shear stress on any oblique plane, concept of principle plane, derivation of expression for principle stresses and planes and plane of maximum Shear stress, position of principle plane and plane of maximum Shear, graphical solution using Mohr's circle of stresses, combined effect of shear and bending in beams. ● Theories of Elastic Failures: The necessity for a theory, Strain Energy, different theories- Maximum principal stress theory, maximum shear stress theory, maximum distortion energy theory, maximum strain theory – their limitations, significance and comparison &applications. ● Conclusion and Summary of Unit
3.	**Shear Force and Bending Moment Diagram**
	● Introduction of Unit ● Shear Force & Bending Moments: Types of beam, types of load, sagging hogging bending moment, SF & BM diagrams, simply supported beams, cantilevers beam and calculation of maximum BM & SF and the point of contra-flexure under concentrated loads, uniformly distributed loads over whole span or a part of it, combination of concentrated loads and uniformly distributed loads and its Problems. ● Shear stresses: Concept, derivation of shear stress distribution formula, maximum and average shears stresses. ● Conclusion and Summary of Unit
4.	**Torsion in Circular Shafts**
	● Introduction of Unit ● Torsion of shafts: Introduction, Basic assumptions, Derivation of shear stress produced in a circular shaft subjected to torsion, Max. torque transmitted by a circular and hollow circular shaft. Shaft in series and parallel, Polar modulus, strength of a shaft and tensional rigidity. ● Buckling of columns: Concept of buckling of columns, Stability of equilibrium: Instability & elastic stability. Long & short columns, ideal strut, derivation of Euler's formula for long column, – assumptions and limitations. Euler's formula for crippling load for columns of different ends. Rankine's formula for intermediate columns, safe load on columns, Eccentric loading of columns. ● Conclusion and Summary of Unit
5.	**Deflection of Beams and Strain Energy**
	● Introduction of Unit ● Transverse deflection of beams: Relation between deflection, bending moment, shear force and load, Transverse deflection of beams and shaft under static loading, area moment method, direct integration method. ● Elastic strain energy: Strain energy due to axial, bending and Torsional loads; stresses due to suddenly applied

	loads; use of energy theorems to determine deflections of beams and twist of shafts. ● Conclusion and Summary of Unit

E. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Strength of Materials	Beer F. P. & Johnston S J	Latest	TMH, New Delhi
2.	Strength of Materials	Ramamurtham, S.	Latest	Dhanpat Rai & Sons
3.	Strength of Materials	Khurmi, R.S.	Latest	Khanna Publishers.
4.	Strength of Materials	Bhavikatti S S	Latest	Vikas Publication House , New Delhi
5.	Strength of material	S.S. Rattan	Latest	TMH, New delhi
6.	Strength of material	Dr. R. K. Bansal	Latest	Laxmi publication Pvt. Ltd., New Delhi
Important Web Links:				
1.	https://nptel.ac.in/courses/112107146/			
2.	https://nptel.ac.in/courses/112107147/			

Code: BMECME3103	Engineering Thermodynamics	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand and apply basic concept of thermodynamics.	L2,L3	PO1, PO3	PSO3
CO – 02	Apply the first and second laws of thermodynamics to analyze various thermodynamic processes and cycles.	L3,L4	PO1,PO4,PO5,	PSO3
CO – 03	Analyze and evaluate the performance of various thermodynamic cycles.	L4,L5	PO4,PO5	PSO3
CO – 04	Determine and utilize thermodynamic properties of pure substances, ideal and real gases, and mixtures.	L3	PO1,PO5	PSO3
CO – 05	Describe the fundamental processes and components of the Rankine cycle, including the boiler, turbine, condenser, and pump.	L2	PO2	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	-	**2**	-	—	—	—	—	—	—	—	—	-	—	**2**
CO 2	**2**	-	-	**3**	**2**	—	—	—	—	—	—	—	—	—	**3**
CO 3	**-.**	-	-	**2**	**2**	—	—	—	—	—	—	—	—	—	**3**
CO 4	**3**	-	-	-	**2**	—	—	—	—	—	—	—	—	—	**3**
CO 5	-	**3**	-	-	—	—	—	—	—	—	—	—	—	—	**3**
WT. AVG	**2.66**	**3**	**0.66**	**2.5**	**2**										**2.8**

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Basic concepts of Thermodynamics	07
2.	Laws of thermodynamics	08
3.	Properties of steam and Vapour process	07
4.	Thermodynamics Relations	07
5.	Vapour power cycle	07

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Basic concepts of Thermodynamics**
	• Introduction of Unit • Basic Concepts: Macroscopic and Microscopic Approaches, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes, Working Substance. Concept of Thermodynamic Work and Heat. • Zeroth law of thermodynamics, Temperature scale, first law of thermodynamics, first law analysis of some elementary process, Steady and unsteady flow energy equations. • Conclusion of Unit including real life applications
2.	**Laws of thermodynamics**
	• **Introduction of Unit** • **Second Law of Thermodynamics**: Heat engine, Heat pump and refrigerator, Second law of thermodynamics, Equivalence of the Kelvin-Plank and Clausius statements. Reversible and Irreversible Processes, Carnot engine, Efficiency of a Carnot engine, Carnot principle, thermodynamic temperature scale, Clausis Inequality. • **Entropy:** Entropy, Calculation of Entropy change, Principle of entropy increase. Temperature-Entropy diagram, Second law analysis of a control volume. • **Availability**: Available energy, Loss in available energy, Availability Function, Irreversibility.
3.	**Properties of steam and Vapour process**
	• Introduction of Unit • Thermodynamic Properties of Fluids: Pure substance, Concept of Phase, Graphical representation of p-v-T data, Properties of steam. Steam tables, Mollier chart. • Ideal Gas and Real Gas: Ideal gas, Real g partial pressures, Gibbs Dalton law, Thermodynamic properties of gases, Internal energy, enthalpy and specific heats of an ideal gas, equations of state, Dalton's law of mixtures.
4.	**Thermodynamics Relations**
	• Introduction of Unit • Thermodynamic Relations: Thermodynamic variables, Independent and dependent variables, Maxwell's thermodynamic relations, Thermodynamic relations involving entropy, Thermodynamic relations involving enthalpy and internal energy, Joule-Thomson coefficient Clapeyron equation. • Power Cycles: Otto cycle, Diesel cycle, Dual cycle, Brayton cycle and Ericsson cycle.
5.	**Vapour power cycle**
	• Vapour power cycle: Rankine cycle, effect of operating conditions on its efficiency, properties of ideal working fluid in vapour power cycle Reheat cycle, regenerative cycle, bleeding extraction cycle, feed water heating co-generation cycle.

E. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Thermal Engineering	R. K. Rajput	Latest	Laxmi Publication, New Delhi.
2.	Engineering Thermodynamics	P.K. Nag	Latest	Tata McGraw-Hill , New Delhi
3.	Thermal Engineering	S.C. Gupta	Latest	Pearson Education Pvt. Ltd. New Delhi.
4.	Thermal Engineering	P.L. Ballany	Latest	Khanna Publication, New Delhi.
5.	An introduction to Thermodynamics	YVC Rao	Latest	New Age publishers, New Delhi.
6.	Fundamental of Engg. Thermodynamics	R.Yadav	Latest	Central Publishing House, Allahabad

Important Web Links	
1	https://nptel.ac.in/courses/101104063/
2	https://nptel.ac.in/courses/11210512/

Code: BMECME3201	Material Science and Material Testing Lab	1 Credit [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Calculate the effective number of atoms, coordination number, packing factors, and Miller indices for crystallographic planes and directions	L3	PO1, PO2, PO3	PSO3
CO – 02	Understand heat treatment and develop skills in metallographic sample preparation for microstructure examination.	L2	PO1	PSO3
CO – 03	Calculate tensile strength of ductile and Brittle material and study its mechanical properties.	L3	PO1, PO3, PO5	PSO3
CO – 04	Calculate hardness of material using Rockwell Hardness tester.	L2	PO1, PO2	PSO3
CO – 05	Calculate Stiffness of spring of Tensile and compression spring,	L2	PO1, PO2, PO3	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	**1**	-	—	—	—	—	—	—	—	—	-	—	**3**
CO 2	**3**	-	-	-	—	—	—	—	—	—	—	—	—	—	**3**
CO 3	**3**	-	**2**	-	**1**	—	—	—	—	—	—	—	—	—	**3**
CO 4	**3**	**2**	-	-	-	—	—	—	—	—	—	—	—	—	**3**
CO 5	**3**	**2**	**1**	-	-	—	—	—	—	—	—	—	—	—	**3**
WT. AVG	**3**	**2**	**1.3**		**1**										**3**

C. DETAILED SYLLABUS

1.	To calculate the effective number of atoms, co-ordination number, packing factors, Miller indices (plane and Directions)
2.	To perform heat treatment of low or medium carbon steel (Annealing and Hardening).
3.	To prepare metallographic samples for metallurgical examination.
4.	To determine hardness of material with the help of Rockwell Hardness tester.
5.	To determine tensile properties of ductile and Brittle material with the help of Universal testing machine (UTM).
6.	To determine the impact strength of materials with the help of Izod Impact Test.
8.	To determine the impact strength of materials with the help of Charpy Impact Test
9.	To determine the endurance limit of the given specimen under fatigue or cyclic loading.
10.	To perform torsion test of a mild steel rod on torsion testing machine.

Virtual Labs	
•	http://sm-nitk.vlabs.ac.in/#

D. RECOMMENDED STUDY MATERIAL:

Lab manual

Code: BMECME3202	IOT and Robotics Lab	1 Credit [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Demonstrate the fundamentals of robotic systems including kinematics and dynamics	L1	PO1, PO3, PO4	PSO3
CO – 02	Demonstrate the fundamentals of robotic manipulator and mobile robots, control methodologies for trajectory following (PD and adaptive control) as applied to manipulator arms	L1	PO1, PO2, PO3	PSO3
CO – 03	Understand the installation process in the embedded controller Arduino	L2	PO1, PO4, PO5	PSO3
CO – 04	Understand installation integrated development environment (IDE), as well as program the board's firmware.	L2	PO1, PO4, PO5	PSO3
CO – 05	Understand the use of different types of sensors and how to connect them to the Arduino	L2	PO1, PO4	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**-**	**1**	**2**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**-**		**3**
CO 2	**3**	**2**	**1**	**-**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**		**3**
CO 3	**3**	**-**	**-**	**2**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**		**3**
CO 4	**3**	**-**	**-**	**2**	**1**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**		**3**
CO 5	**3**	**-**	**-**	**2**	**-**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**		**3**
WT. AVG	**3**	**2**	**1**	**2**	**1**										**3**

C. DETAILED SYLLABUS

1.	To study Forward and inverse kinematics of Robotics
2.	To study dynamics of robot manipulators
3.	To study control of robot manipulators like P, PD and PID control.
4.	To study and implementation of 3-axis accelerometer.
5.	To study controlling mechanism of DC motor and its implementation in robotics
6.	To study controlling Mechanism of Stepper Motor and its implementation in robotics
7.	Using Arduino print “Hello World”

8.	LED bar graph display
9.	Measuring temperature by Thermistor
10.	Controlling a relay in robotics.

D. RECOMMENDED STUDY MATERIAL:

Lab manual

E. VIRTUAL LAB

●	http://vlabs.iitkgp.ac.in/mr/index.html
●	http://vlabs.iitkgp.ernet.in/rcs/index.html
●	https://vlab.amrita.edu/?sub=62&brch=271

Code: BMECME3203	Additive Manufacturing and Prototyping Lab	1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	Demonstrate appropriate level of understanding on principles of additive manufacturing processes.	L2	PO1, PO2, PO3, PO4	PSO2, PSO3
CO2	Choose appropriate materials for additive manufacturing processes	L2	PO1, PO2, PO3, PO4, PO7	PSO2, PSO3
CO3	Apply suitable CAD tools and CAD interface for additive manufacturing process	L3	PO1, PO2, PO3, PO4, PO5, PO12	PSO2, PSO3
CO4	Develop physical prototypes by identifying suitable process with optimum process parameters	L5	PO1, PO2, PO3, PO4, PO6, PO7, PO12	PSO2, PSO3
CO5	Create physical objects that facilitates product development and prototyping requirements.	L5	PO1, PO2, PO3, PO4, PO6, PO7, PO12	PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	-	-	-	-	-	-	-	-	2	-	2
CO2	2	2	2	1	-	-	3	-	-	-	-	-	2	-	2
CO3	2	3	2	1	3	-	-	-	-	-	-	1	2	-	2
CO4	2	3	3	2	-	2	2	-	-	-	-	1	2	-	2
CO5	2	2	3	1	-	2	2	-	-	-	-	2	2	-	2
WT. AVG	**2**	**2.2**	**2.4**	**1.2**	**3**	**2**	**2.3**	-	-	-	-	**2**	**2**	-	**2**

C. LIST OF EXPERIMENT

Exp No.	Name of Experiment
1	To study the various types of additive manufacturing process
2	To study the step-by-step procedure of additive manufacturing
3	To study the fused deposition modelling (FDM)
4	Draw simple 2D geometries using sketcher commands.
5	Draw the given 2D geometry using sketcher workbench. (Without Grid)
6	Draw simple 3-D drawings using 3D modelling commands.
7	Slicing of STL file and study the effect of process parameter like layer thickness, Orientation and infill on build time using software.
8	3D Printing of modelled component by varying layer thickness.
9	3D Printing of modelled component by varying orientation.
10	Identifying the defects in 3D Printed components.

D. ONLINE RESOURCES

Important Web Links	
1	https://all3dp.com/2/meshmixer-tutorial-easy-steps-beginners/
2	https://www.youtube.com/watch?v=dvCGHgftNIg
3	https://www.youtube.com/watch?v=VEYGm9KTcTA
4	https://www.youtube.com/watch?v=eUNTlb5pEWA
5	https://www.youtube.com/watch?v=nl85ATWkKXw

Code: BMECME3204	Technical Seminar	1 Credits [LTP:0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Identify and gather relevant information on advanced topics within their field.	L2	PO1, PO2, PO5	PSO3
CO – 02	Analyze and synthesize information from various sources, including research papers, to create a comprehensive report.	L3	PO1, PO2, PO3, PO5	PSO3
CO – 03	Develop and enhance technical writing skills for preparing well-structured seminar reports.	L3	PO1, PO2, PO3, PO5	PSO3
CO – 04	Prepare and deliver effective seminar presentations using appropriate slides and visual aids.	L3	PO1, PO2, PO3 PO4, PO5	PSO3
CO – 05	Engage in discussions and provide constructive feedback during seminar sessions, demonstrating effective communication skills.	L3	PO1, PO2, PO3 PO4, PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	-	–	1	–	–	–	–	–	–	–	–	–	2
CO 2	3	2	2	–	2	–	–	–	–	–	–	–	–	–	3
CO 3	3	3	2	–	2	–	–	–	–	–	–	–	–	–	3
CO 4	3	3	2	2	3	–	–	–	–	–	–	–	–	–	3
CO 5	3	3	2	2	3	–	–	–	–	–	–	–	–	–	3
WT. AVG	**2.8**	**2.6**	**2.0**	**2.0**	**2.2**										**2.8**

C. Guidelines of Seminar

1. For seminar every student will individually study a topic assigned to him / her and submit a report and shall deliver a short lecture / Seminar on the topic at the end of term.

2. Selection of topic should be done by students in consultation with concerned guide

a). Topic should be related to branch but it should be extended part of the branch (latest and advance topic).

b). The topic should be such that the student can gain latest knowledge. Student should preferably refer at least one research paper

3. Seminar topic should not be repeated in the department and registration of the same should be done on first come first served basis.

4. Seminar report should be submitted in paper bound copy prepared with computer typing

a). Size of report depends on advancement of topic.

b). Student should preferably refer minimum 5 reference books / magazines.

c). Format of content: i. Introduction. ii. Literature survey. iii. Theory 1) Implementation 2) Methodology 3) Application 4) Advantages, Disadvantages. iv. Future scope. v. Conclusion

Code: BMECME3205	Computer Aided Design Lab-1	1 Credits [LTP:0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the AutoCAD interface and use basic 2D drawing commands.	L2	PO1, PO3	PSO2
CO – 02	Create accurate 2D mechanical drawings using various AutoCAD tools and layers.	L3	PO1, PO3, PO5	PSO2
CO – 03	Develop sectional and multi-view drawings of machine components.	L4	PO1, PO3, PO5	PSO2
CO – 04	Create 3D models using AutoCAD tools like EXTRUDE, REVOLVE, and BOOLEAN operations	L3	PO1, PO3, PO5	PSO2
CO – 05	Prepare 2D projections and layouts from 3D models with annotations and dimensions.	L3	PO1, PO3, PO5	PSO2

B. **MAPPING MATRIX OF CO, PO, & PSO**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	-	**2**	-	**2**	—	—	—	—	—	—	**2**	-	**3**	—
CO 2	**3**	-	**3**	-	**3**	—	—	—	—	—	—	**2**	—	**3**	—
CO 3	**2**	-	**3**	-	**2**	—	—	—	—	—	—	**2**	—	**3**	—
CO 4	**3**	-	**3**	-	**3**	—	—	—	—	—	—	**2**	—	**3**	—
CO 5	**2**	-	**2**	-	**2**	—	—	—	—	—	—	**2**	—	**2**	—
WT. AVG	**2.6**	-	**2.6**	-	**2.4**	—	—	—	—	—	—	**2**	—	**2.6**	—

C. DETAILED SYLLABUS

1.	Understanding of AutoCAD User Interface and Basic Drawing Commands
2.	Drawing simple geometric shapes using basic draw and modify commands.
3.	Creating slightly complex 2D shapes using commands like OFFSET, TRIM, FILLET, and CHAMFER.
4.	Developing machine element drawings using layers, hatching, and dimensioning.
5.	Creating orthographic views (top, front, side) with accurate annotations.
6.	Drawing sectional views and detailed component drawings using hatching tools.
7.	Modeling basic 3D objects using EXTRUDE, PRESSPULL, and REVOLVE commands.
8.	Creating simple 3D parts and visualizing them in isometric and perspective views
9.	Using Boolean operations like UNION, SUBTRACT, and INTERSECT for 3D modeling.
10.	Assembling multiple 3D components and organizing them using layers and blocks.
Virtual Labs	
•	http://sm-nitk.vlabs.ac.in/#

BMEEME3111	Material Science and Characterization Techniques	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	**Demonstrate** comprehension of material properties, classification, and selection through analysis and application	L2	PO1, PO2, PO4, PO5	PSO2
CO2	**Understanding** of engineering material structure, defects, and deformation mechanisms	L2	PO1, PO2, PO4	PSO2
CO3	**Analyze** solidification processes and phase transformations in alloys	L4	PO1, PO2, PO4, PO5	PSO2
CO4	**Analyze** heat treatment principles and techniques	L4	PO1, PO2, PO4, PO5	PSO2
CO5	**Analyze** the materials through destructive and non-destructive testing, and characterization techniques	L4	PO1, PO2, PO4, PO5	PSO2

B. MAPPING MATRIX OF CO, PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	2	1	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	1	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	-	3	2	-	-	-	-	-	-	-	-	2	-
CO4	2	3	-	2	1	-	-	-	-	-	-	-	-	2	-
CO5	2	2	-	2	1	-	-	-	-	-	-	-	-	2	-
WT. AVG	**2**	**2.4**	**-**	**2**	**1.25**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Classification of Engineering materials	8
2.	Structure of Materials	8
3.	Equilibrium Diagrams	8
4.	Heat Treatments	8
5.	Mechanical Testing and Characterization Techniques	8

D. DETAILED SYLLABUS

Unit	Unit Details
1	**Classification of Engineering materials**
	• Introduction of Unit • Engineering materials, classification of engineering materials, metals and alloys, polymers, ceramics, composites. General properties of engineering materials, stress-strain diagram. Selection of engineering materials as per the properties and application areas • Metallic alloys: Ferrous alloys, plain carbon and alloy steels classification, stainless steel, spring steel, tool steels, corrosion resistant steels, high speed steels etc. Cast iron and types. Nonferrous metals and alloys and their applications.

	• Classification of non-metallic materials: Plastics, ceramics, composites types, their properties, applications and case studies. • Advanced Materials: Materials for modern vehicles, components and their case studies. smart materials, advanced composites and their applications, waste materials and their utilization. • Conclusion of Unit including real life applications
2	**Structure of Materials**
	• Introduction of Unit • Structure of engineering materials. Crystalline structure of solids; development of grain structure, unit cell, atomic and nucleus arrangement. Space lattice, lattice parameters, coordination number, atomic packing factor. • Crystal lattice of simple cubic, body centered cubic, face centered cubic, hexagonal crystal structures. Miller Indices and crystal structure determination methods. • Crystal imperfection: Point defects- vacancy, Schottky's defect, Frankel defect, linear defects or dislocations, surface and volume defects. • Plastic deformation- Role of dislocation, slip, twinning, strain hardening, Bauschinger's effect. Recovery, recrystallization and grain growth • Conclusion of Unit including real life applications
3	**Equilibrium Diagrams**
	• Introduction of Unit. • Solidification of metals and of some typical alloys: Mechanism of crystallization (i) nuclear formation (ii) crystal growth. General principles of phase transformation in alloys, phase rule, phase diagram and equilibrium diagrams, • Binary isomorphous alloy system, Hume-Rothery rule, Binary system with limited solid solubility of terminal phase and in which solubility decreases with temperature and also alloy with peritectic transformation. • Equilibrium diagram of a system whose components are subject to allotropic change. Iron carbon equilibrium diagram, phase transformation in the iron carbon diagram, eutectic, peritectic, eutectoid and peritectoid reactions and microstructures. • Conclusion of Unit including real life applications
4	**Heat Treatments**
	• Introduction of Unit • TTT curve- Cooling curves superimposed on Isothermal Transformation diagram, critical cooling rate. (i) Formation of Martensite, Bainite • Principles of heat treatment, types and applications. Annealing, normalizing, hardening, tempering types, diagram, objectives and applications. • Chemical Heat treatment of steels: Case hardening, carburising, nitriding, cyaniding, carbonitriding. Flame and Induction hardening • Hardenability and methods for determination of hardenability. Over-heated and burnt steel, temper brittleness -its causes and remedies • Conclusion of Unit including real life application.
5	**Mechanical testing and Characterization Techniques**
	• Introduction of Unit • Destructive Testing; Mechanical Properties and Testing: Types of fracture, testing of materials under tension, compression and shear loads – hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test. • Non-destructive testing: Advantages and limitations of destructive and non-destructive testing, liquid penetrant magnetic particle inspection, and ultrasonic test, radiography and eddy current test. • Characterization techniques: SEM, FEM, XRD, EDS, DTA, DSC, TGA etc. • Conclusion of Unit including real life applications

E. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1.	Material science and metallurgy for Engineers	Dr V.D.Kodgire	Latest	Vrinda Publications
2.	Material Science.	Narula and Gupta	Latest	New Age Publishers
3.	A Text Book of Material Science & Metallurgy	K. M. Gupta	Latest	Umesh Publications
4.	Material Science and Engineering-An Introduction	Callister W.D.	Latest	John Wiley & Sons. Delhi.
5.	Engineering Materials	Kenneth G. Budinski	Latest	Prentice Hall of India, New Delhi
6.	Material Science & Engineering	V. Raghvan	Latest	Prentice Hall of India, New Delhi
7.	Materials Characterization Techniques	S Zhang, L. Li and Ashok Kumar	Latest	CRC Press
Important Web Links				
1	https://nptel.ac.in/courses/112108150/			
2	https://nptel.ac.in/courses/113106032/			
3	https://nptel.ac.in/courses/115103030/			

Code: BMEEME3112	Operation Management	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	**Understand** the scope of operation management and demand forecasting.	L2	PO1, PO2, PO11, P12	PSO2, PSO3
CO2	**Analyze** the various types of production system and capacity planning.	L4	PO1, PO2, PO11	PSO2, PSO3
CO3	**Apply** the production planning objectives and techniques.	L3	PO1, PO2, PO5, PO11	PSO2, PSO3
CO4	**Analyze** the concepts of production control system, JIT, pull system etc.	L4	PO1, PO2, PO5, PO11	PSO2, PSO3
CO5	**Apply** the concept of material management, requirement, and functions.	L3	PO1, PO2, PO11, P12	PSO2, PSO3

B. MAPPING MATRIX OF CO,PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	2	2	-	2	2
CO2	2	3	-	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	-	-	2	-	-	-	-	-	2	-	-	2	2
CO4	2	3	-	-	2	-	-	-	-	-	2	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	2	2	-	2	2
WT. AVG	**2.2**	**2.6**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2.2**	**2**	**-**	**2**	**2**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Basics of Operation Management	7
2.	Production Systems	8
3.	Production Planning	8
4.	Production Control	7
5.	Material Management	8

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Basics of Operation Management**
	• Introduction of Unit • Introduction: Scope of Operations Management, operations manager and the management process. Operations Strategy, Competitiveness and Productivity. • Demand Forecasting: components of forecasting demand, Approaches to forecasting: Qualitative methods, Time series methods, Regression methods, Selection of forecasting technique. ● Conclusion of Unit including real life applications
2.	**Production Systems**

	• Introduction of Unit • Products and Services, Process, Types of Production Systems: Mass, Batch, Job shop production. Product and process matrix. Process planning and Process analysis. Capacity Planning: Defining and measuring capacity, steps in capacity planning process, determining capacity requirements, Capacity alternatives. • Conclusion of Unit including real life applications
3.	**Production Planning**
	• Introduction of Unit • Production Planning: Production planning objective and functions, Bill of material, Capacity and man power requirement planning, Planning levels: long range, Intermediate range and Short range planning, aggregate planning; Objective, Strategies. • Conclusion of Unit including real life applications
4.	**Production Control**
	• Introduction of Unit • Production Control: Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up, batch production and mass production systems, • Just in Time and Lean Production Basic element in JIT, Pull system, Push system, Kanban production control system, Benefits of JIT. • Conclusion of Unit including real life applications
5.	**Material Management**
	• Introduction of Unit • Material Management: Objectives, scope and functions of material management, planning, procurement, storing, ending and inventory control. Purpose of inventory, inventory cost, inventory control systems, Selective inventory control systems, Determination of EOQ, Lead time and reorder point. • Conclusion of Unit including real life applications

E. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1.	Operations Management	Krajewski, Ritzman, Kansal	Latest	Pearson
2.	Operations Management	Roberta S. Russell	Latest	Pearson/ PHI
3.	Production and Operations Management	Everette. Adam Jr., Ronald J. Ebert	Latest	PHI
4.	Operations Management	Russell & Taylor III	Latest	Pearson
5.	Operations Management	McGregor D	Latest	McGraw-Hill
6.	Operations Management	Chase, Jacobs, Aquilano, Agarwal	Latest	TMH
Important Web Links				
1	https://nptel.ac.in/courses/112107238/			
2	https://nptel.ac.in/courses/110106046/			
3	https://nptel.ac.in/courses/110106045/			

Code: BMEEME3113	SMART TECHNOLOGIES FOR INDUSTRY 4.0	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the evolution, drivers, and challenges of Industry 4.0 and compare the modern factory with the Industry 4.0 factory.	L2	PO1, PO2	PSO3
CO – 02	Apply concepts of IoT, IIoT, smart manufacturing, and predictive analytics in the context of Industry 4.0.	L3	PO1, PO2, PO5	PSO3
CO – 03	Apply enabling technologies and systems for Industry 4.0, including cyber physical systems, robotic automation, and cyber security.	L3	PO1, PO2, PO4, PO5	PSO3
CO – 04	Understand the role of data, information, and knowledge in organizations and apply cloud computing concepts in Industry 4.0.	L3	PO1, PO2, PO3	PSO3
CO – 05	Understand various case studies and applications of Industry 4.0, and identify opportunities and challenges for future skills and strategies.	L2	PO1, PO2, PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	–	–	–	–	–	–	–	–	–	–	3
CO 2	3	3	-	-	2	–	–	–	–	–	–	–	–	–	3
CO 3	3	3	-	2	2	–	–	–	–	–	–	–	–	–	3
CO 4	3	3	2	-	-	–	–	–	–	–	–	–	–	–	3
CO 5	3	3	-	2	2	–	–	–	–	–	–	–	–	–	3
WT. AVG	**3.0**	**2.8**	**2.0**	**2.0**	**2.0**										**3.0**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction to Industry 4.0	7
2	Road to Industry 4.0	7
3	Related Disciplines, System, Technologies for enabling Industry 4.0	8
4	Role of data, information, knowledge and collaboration in future organizations	7
5	Other Applications and Case Studies	7

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Industry 4.0**
	• Introduction of Unit • The Various Industrial Revolutions, Digitalisation and the Networked Economy, Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 , The Journey so far: Developments in USA, Europe, China and other countries, Comparison of Industry 4.0 Factory and Today's Factory, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation • Conclusion and Summary of Unit
2.	**Road to Industry 4.0**
	• Introduction of Unit • Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services, Smart Manufacturing , Smart Devices and Products, Smart Logistics, Smart Cities, Predictive Analytics • Conclusion and Summary of Unit
3.	**Related Disciplines, System, Technologies for enabling Industry 4.0**
	• Introduction of Unit • Cyber physical Systems, Robotic Automation and Collaborative Robots , Support System for Industry 4.0 , Mobile Computing, Related Disciplines, Cyber Security • Conclusion of Unit including Real Life Application
4.	**Role of data, information, knowledge and collaboration in future organizations**
	• Introduction of Unit • Resource-based view of a firm, Data as a new resource for organizations, Harnessing and sharing knowledge in organizations, Cloud Computing Basics, Cloud Computing and Industry 4.0 • Conclusion of Unit including Real Life Application
5.	**Other Applications and Case Studies**
	• Introduction of Unit • Industry 4.0 laboratories, IIoT case studies, Case studies from HKPolyU students, opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world • Conclusion of Unit including Real Life Application

E. RECOMMENDED STUDY MATERIAL:

S.No.	Reference Book	Author	Edition	Publication
1.	The Fourth Industrial Revolution	Klaus Schwab	Latest	World Economic Forum
2	Industry 4.0: The Industrial Internet of Things	Alasdair Gilchrist	Latest	Press
3.	Industry 4.0 Value Roadmap: Integrating Technology and Market Dynamics for Strategy, Innovation and Operations	Tuğrul U. Daim	Latest	Springer
4	Industry 4.0 and Regional Transformations	Lisa De Propris	Latest	Routledge
Important Web Links:				
1	https://en.wikipedia.org/wiki/Industry_4.0			
2	https://www.dqindia.com/role-digital-verification-signature-scaling-industry-4-0/			

Code: BULCHU3106	COMMUNICATION SKILL I	1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES: After Successful completion of the course students will be able

CO	At the end of this course, learners will be able to:	Bloom Level
CO – 01	Demonstrate depth of understanding, observing complexity, improve insight and develop healthy interpersonal relationships.	L1
CO – 02	Determine the main ideas of the text by using various reading skills and compare & contrast the most important points with the help of such skills.	L3
CO – 03	Practice the qualities of writing skills style by applying the concepts of sentence conciseness, accuracy, readability, coherence and by avoiding wordiness or ambiguity.	L3
CO – 04	Distinguish listening skills as per their patterns and interpret the audios based on different situations	L2
CO – 05	Demonstrate the understanding of impactful speaking skills, presentation skills & telephonic conversation by considering the need of the audience.	L1

B. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Intrapersonal/Interpersonal Skills	6
2.	Reading Skills	8
3.	Writing Skills	8
4.	Listening Skills	6
5.	Speaking Skills	8

C. DETAILED SYLLABUS

LIST OF LABS	
1.	Self – Awareness & Self-Introduction
2.	Goal Setting: Ambition induced, interest induced or environment conditioned
3.	Cultivating Conversational Skills
4.	Role Plays: Selection of varied plots, characters & settings
5.	Reading skills, I: Newspaper Reading & General Article Reading
6.	Writing Skills, I: Story Making by jumbled words
7.	Understanding and Applying Vocabulary
8.	Listening Skills, I: Types and practice by analyzing situational listening
9.	Speaking Skills, I: JAM
10.	PowerPoint Presentation Skills-I

D. COs AND POs MAPPING

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

E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3
CO1	2	-	1
CO2	2	-	1
CO3	2	-	1
CO4	2	-	1
CO5	2	-	1

Code: BUVCCE3101	GREEN BUILT ENVIRONMENT	2 Credits [LTP: 2-0-0]

A. COURSE OUTCOMES: After Successful completion of the course students will be able

CO	At the end of this course, learners will be able to:	Bloom Level
CO – 01	Recall key factors influencing microclimates.	L1
CO – 02	Explain the principles of efficient irrigation practices.	L2
CO – 03	Design lighting controls to meet energy efficiency standards.	L3
CO – 04	Evaluate the environmental impact of different construction materials.	L4
CO – 05	Recall codes and standards related to indoor air quality.	L1

B. OUTLINE OF THE COURSE

Unit No.	Title of The Unit	Time required for the Unit (Hours)
1.	Sustainable Architecture & Sites	6
2.	Water Management	8
3.	Energy Management	10
4.	Sustainable Building Materials	6
5.	Indoor Environmental Quality	10

C. DETAILED SYLLABUS

Unit	Unit Details
1.	**Sustainable Architecture & Sites**
	• Introduction of Unit • Integrated Approach for Green Building design: Factors for Site selection, Understanding Site Ecology & Site Analysis • Soil erosion & Pollution control measures: Types of Soil Erosion, Strategies to Mitigate Land Degradation, Design Techniques & Challenges • Microclimate: Factors affecting microclimate & Heat Islands, Strategies to handle heat island in built environment, Designing Green Spaces and Enhancing Biodiversity in built environment • Universal Design: Key accessibility issues and Design guidelines.
2.	**Water Management**
	• Introduction of Unit • Water Balance and approach for water efficiency: 3R Approach for water efficiency – Reduce, Reuse/ Recycle and Recharge • Water efficient plumbing fixtures, Standards & Codes • Efficient irrigation practices – Hydrozoning, Control devices for water supply, Irrigation systems – Drip & Sprinklers • Wastewater treatment & reuse, wastewater treatment technologies: Physical, Biological and Natural • Rainwater harvesting and Utilization, Groundwater recharge techniques: Design consideration.
3.	**Energy Management**

	• Introduction of Unit • Introduction, Performance Evaluation and Approach for Energy Efficiency in Buildings • Energy Efficiency Standards & Codes: ECBC 2017 & EPI, ASHRAE 90.1, ASHRAE 62.1, ASHRAE 55, ASHARE 170, ISHRAE 1001. • Star labelling for appliances • Air Conditioning: Types of air conditioning systems, Design Considerations and control systems • Renewable Energy systems and technologies.
4.	**Sustainable Building Materials**
	• Introduction of Unit • Attributes of Sustainable Building Materials: Recycled content, Regional material, Renewable material, Embodied energy, Embodied carbon, Material performance, Recyclability, Elimination of hazardous materials • Ecolabeling of Products: Types of Ecolabels – Type I, II & III • Sustainable Materials for Green Buildings: Ready mix concrete, Construction Blocks, Glass, Steel TMT Bars, Construction Chemicals, Insulation Materials, Cement, Paints • Waste management during construction & post-occupancy: Segregation strategies, Types of waste management – organic, inorganic, e-waste, hazardous waste
5.	**Indoor Environmental Quality**
	• Introduction of Unit • Indoor Air quality: Codes and Standards, Fresh air requirements, Design considerations • Approach for improving Indoor air quality: Measures to reduce sick building syndrome, Demand control ventilation, CO2 monitoring in buildings, Air quality monitoring • Enhancing occupants' Comfort, Health and Wellbeing: Thermal Comfort, Visual Comfort, Acoustics, Ergonomics.

D. RECOMMENDED STUDY MATERIAL:

S.No	Reference Book	Author	Edition	Publisher
1.	Guide on Green Built Environment	IGBC	2019	IGBC
2.	IGBC Green Homes rating system	IGBC	2021	IGBC

E. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO – 01	3	2	1		-	-	-	-	-	-	-	-
CO – 02	2	3	2		-	-	-	-	-	-	-	-
CO – 03	3	3	2		-	-	-	-	-	-	-	-
CO – 04	2	3	3	3	-	-	-	-	-	-	-	-
CO – 05	2	3	2	3	-	-	-	-	-	-	-	-

F. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3
CO – 01	3	-	-
CO – 02	3	-	-
CO – 03	1	-	-
CO – 04	3	-	-
CO – 05	3	-	-

Note: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development.

Code: BUACHM3215	PROFESSIONAL SKILLS-I	1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES: After Successful completion of the course students will be able

CO	At the end of this course, learners will be able to:	Bloom Level
CO – 01	Compare the professional and personal approach towards any task and demonstrate their understanding by displaying professional attitude in the assigned tasks.	L4
CO – 02	Recognize, explain, and use the formal elements of specific genres of organizational written communication: reports, proposals, memorandums, web pages, wikis, blogs, business letters, and promotional documents etc...	L3
CO – 03	Prepare and deliver a clear and fluent demonstrative, informative, and persuasive presentation and enlarge their vocabulary by keeping a vocabulary journal.	L4
CO – 04	Demonstrate preparedness for any type of interview from classic one-on-one interview to panel interviews, Phone/Skype interviews, Behavioral/Situational etc. along with sharping the ability to critically analyze a given piece of information and collectively work in a group to arrive at a solution or develop a perspective.	L5
CO – 05	Understand negotiation and time management to identify steps for proper negotiation preparation & learn bargaining techniques and strategies of inventing options for mutual gain and move negotiations from bargaining to closing.	L2

B. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Professional Attitude & Approach	6
2.	Professional Writing-I	8
3.	Presentation Skills: Structure Study	2
4.	Interview Skills & Group Discussion	4
5.	Negotiation Skills & Time Management	4

C. DETAILED SYLLABUS

LIST OF LABS	
1.	Professional & Ethical Approaches: Degree of adherence, Business world & meeting deadlines
2.	Job Hunting and Networking: Skill Branding & Usage of Online Platforms
3.	Trust Building & Cultural Etiquettes
4.	Professional Writing-I: Direct-Indirect approaches to Business Writing-Five main stages of writing Business Messages.
5.	Professional Email Writing
6.	Resume Building-I: Difference between C.V. & Resume, formats, points to cover, practice sessions
7.	E-Learning & E-Content Development-I
8.	Presentation Skills: format & structure of presentations, using tools & techniques
9.	Job Interviews I: Preparation and Presentation
10.	Advanced Group Discussion – I
11.	Negotiation Skills & and Conflict Resolution-I
12.	Professional Code of Ethics & Effective Time Management

D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO – 01	2	2	–	–	–	–	–	3	2	2	–	2
CO – 02	2	–	–	–	–	–	–	–	–	3	2	2
CO – 03	–	–	–	–	–	–	–	–	2	3	1	3
CO – 04	2	3	–	2	–	–	–	2	3	3	2	2
CO – 05	–	2	–	–	–	–	–	2	3	3	3	2

E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3
CO – 01	2	2	3
CO – 02	1	3	2
CO – 03	–	3	2
CO – 04	2	2	3
CO – 05	1	2	3

Note: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

FOURTH SEMESTER

Code: BMECME4101	DESIGN OF MACHINE ELEMENTS	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the selection of engineering material and application of limit, fits & tolerances.	L2	PO1, PO3	PSO2
CO – 02	Apply to design concepts to bolted joint and Rivet joint.	L3	PO1, PO2, PO3	PSO2
CO – 03	Understand the designing process of shafts under different conditions.	L2	PO1, PO3	PSO2
CO – 04	Understand the design concepts of pivot, collar, ball and roller bearings based on load-life relationships.	L2	PO1, PO2, PO3	PSO2
CO – 05	Understand the design consideration under fatigue load.	L2	PO1, PO3	PSO2

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**-**	**2**	**-**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**-**	**2**	**-**
CO 2	**2**	**1**	**3**	**-**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**3**	**-**
CO 3	**3**	**-**	**2**	**-**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**3**	**-**
CO 4	**3**	**2**	**1**	**-**	**-**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**3**	**-**
CO 5	**3**	**-**	**2**	**-**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**3**	**-**
WT. AVG	**2.8**	**1.5**	**2**											**2.8**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Design processes and Material selection	07
2.	Design for Fluctuating Loads	08
3.	Design of Joints	08
4.	Design of shafts	08
5.	Design of Bearings	08

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Design processes and Material selection**
	● Introduction of Unit ● Materials: Properties and IS coding of various materials, Selection of material from properties and economic aspects. ● Manufacturing aspects in Design: Selection of manufacturing processes on the basis of design and economy, Influence of rate of production, standard size, Influence of limits, fits tolerances and surface finish. Change in the shape of the designed element to facilitate its production, Design of castings, working drawing. ● Conclusion and Summary of Unit
2.	**Design for Fluctuating Loads**
	● Introduction of Unit ● Stress concentration – causes & remedies, Fatigue Considerations in Design: S-N curve, Variable load, loading pattern, Endurance stresses, influence of size, surface finish, notch sensitivity and reversed stresses. ● Goodman line, Soderberg, Design of machine members subjected to combined, steady and alternating stresses ● Conclusion and Summary of Unit
3.	**Design of Joints**
	● Introduction of Unit ● Design of machine elements subjected to direct stress: Introduction of bolted joint, Bolts of Uniform Strength, Bolted Joints under Eccentric Loading, Eccentric Load Acting Parallel to the Axis of Bolts, Eccentric Load Acting Perpendicular to the Axis of Bolts. ● Rivet joint: Introduction of rivet joint, Methods of Riveting, types of Riveted Joints, Failures of a Riveted Joint, efficiency of a Riveted Joint, Riveted Joint for Structural Use–Joints of Uniform Strength (Lozenge Joint). ● Conclusion and Summary of Unit
4.	**Design of shafts**
	● Introduction of Unit ● Transmission shafts, Shafts design on strength basis, ASME code for shaft design, Design consideration & causes of failure of shaft, Shaft subjected to combine twisting moment and bending moment. Design of hollow shaft on strength basis & Torsional rigidly basis. Flexible shafts, Shaft subjected to fluctuating loads ● Conclusion and Summary of Unit
5.	**Design of Bearings**
	● Introduction of Bearing, uses and their types. ● Design of pivot and collar bearing, Design of sliding & journal bearing; Selection of ball and roller bearing based on static and dynamic load carrying capacity using load-life relationship, Design of journal bearings using Raimondi and Boyd's Charts. Lubricants and their properties, types of lubrication – Boundary, mixed and hydrodynamic lubrication. ● Conclusion and Summary of Unit

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1.	Introduction to Machine Design	Bhandari, V.B.,	Latest	Tata McGraw-Hill
2.	A Text book of Machine Design	Khurmi, R.S., Gupta, J.K.,	Latest	S. Chand Publication.
3.	Design of Machine element	Bhandari, V.B.,	Latest	Tata McGraw-Hill
4.	Mechanical Engineering Design	Shigley, J.E.,	5^{th} Ed.	---
5.	Machine Design Databook	Lingaiah, K.	Latest	Tata McGraw-Hill
6.	Design of Machine Elements	C.S.Sharma& Kamlesh	Latest	Prentice Hall of India Pvt. Ltd.
Important Web Links				
1	https://nptel.ac.in/courses/112105124/			

Code: BMECME4102	Automobile and IC Engine	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	Recall and explain the basics of IC engines and their performance parameters	L2, L4, L5	PO1, PO2, PO3, PO4, PO5	PSO2
CO2	Describe combustion in SI and CI engines and identify abnormal combustion types	L2, L4	PO1, PO2, PO3, PO4, PO5	PSO2
CO3	Explain engine operating systems like carburetion, fuel injection, lubrication, and ignition.	L2, L4,	PO1, PO2, PO3, PO4, PO5	PSO2
CO4	Compare chassis types, body construction, and their effects on vehicle performance.	L2, L4	PO1, PO2, PO3, PO4, PO5	PSO2
CO5	Analyze automotive systems (transmission, suspension, steering, brakes) and suggest suitable applications.	L2, L3, L4	PO1, PO2, PO3, PO4, PO5	PSO2

B. MAPPING MATRIX OF CO, PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	3	2	-	-	-	-	-	-	-	-	2	-
CO2	3	2	3	2	2	-	-	-	-	-	-	-	-	2	-
CO3	2	3	2	3	2	-	-	-	-	-	-	-	-	2	-
CO4	2	2	3	3	2	-	-	-	-	-	-	-	-	2	-
CO5	3	2	3	2	3	-	-	-	-	-	-	-	-	2	-
WT. AVG	**2.4**	**2.4**	**2.6**	**2.6**	**2.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction to IC Engine	10
2	Combustion in IC Engines	8
3	Engine Operating Systems:	7
4	Automobile Chassis & Body	8
5	Automotive Systems	7

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to IC Engine**
	• Introduction of Unit • **Introduction:** Definition of Engine, Heat Engine, Classification of IC Engine, Basic Engine Components and Nomenclature, The Working Principle of Engines, Two-stroke, Four-stroke SI and CI Engines, Comparison of Four-Stroke and Two-Stroke Engines, Actual Engines, Cycle of Operation. • **Engine Performance Parameters:** Indicated Thermal Efficiency, Brake Thermal Efficiency, Mechanical Efficiency, Volumetric Efficiency, Relative Efficiency or Efficiency Ratio, Mean Effective Pressure,

	Mean Piston Speed, Specific Power Output, Specific Fuel Consumption, Inlet-Valve Mach Index, Air-Fuel Ratio, Calorific Value. • **Air-Standard Cycles and Their Analysis:** The Otto Cycle, The Diesel Cycle, The Dual Cycle, Comparison of the Otto, Diesel and Dual Cycles. • Conclusion of Unit including Real Life Application
2.	**Combustion in IC Engines**
	• Introduction of Unit • **Combustion in S.I. Engines**: Normal Combustion and abnormal combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation of) – Fuel requirements and fuel rating, anti-knock additives – combustion chamber – requirements, types. • **Combustion in C.I. Engines**: Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating. • Conclusion of Unit including Real Life Application
3.	**Engine Operating Systems:**
	• Introduction of Unit • **Carburetion:** Carburetion, Factors Affecting Carburetion, Air–Fuel Mixture Requirements at Different Loads and Speeds, Idling Range, Cruising Range, Power Range, Principle of Carburetion, The Simple Carburetor, Calculation of the Air–Fuel Ratio. • **Fuel Injection**: Classification of Injection Systems, Injection in SI Engine, Electronic Injection Systems Multi-Point Fuel Injection (MPFI) System, Sequential Fuel injection, Injection Timing, Electronic Diesel Injection System. • **Lubrication**: Functions of Lubrication, Types of lubrication, Properties, Rating and Classification of lubricating oil, Additives. • **Ignition**: Energy requirement for ignition, requirements of an ignition system, modern ignition systems (TCI and CDI), Triple Spark Technology, distributor-less ignition system, firing order, Ignition timing. • Conclusion of Unit including Real Life application
4.	**Automobile Chassis & Body**
	• Introduction of Unit • **Introduction to Automobile**: Historical Development of automobiles, classification of automobiles, Layout of Automobile Vehicle, their constructional features and materials, Current developments in vehicles. • **Chassis, Frame & Body**: Types of frames, engine location, Comparison of front and rear mounting of engine, arrangement of clutch assembly, gearbox, and propeller shaft with universal joints. front and rear differentials, rear, front and four-wheel drives, their relative merits, types of chassis, pre requirements of body, types of bodies & their construction, aerodynamic considerations in body profiling, ergonomical considerations, defects in frames and body. • Conclusion of Unit including Real Life application
5.	**Automotive systems**
	• Introduction of Unit • **Transmission System**: Functions of gearbox, gears & gear ratios, types of gearboxes, Automatic transmission system; overdrive, propeller shaft, universal joints, Differential. • **Suspension System**: Principle, type of suspension system, conventional and independent front and rear axle, rubber and air suspensions, shock absorbers. • **Steering System**: Steering layout, types of steering gears, checking wheel alignment and steering geometry • **Wheels &Tyres**: Types of wheels, types of tyres, tyre materials, tyre designations and factors affecting tyre life. • **Braking System**: Principle and working of various types of brakes, anti-lock brake systems (ABS). • Conclusion of Unit including Real Life application

E. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1	Internal Combustion Engines	Ganesan.V	Latest	Tata McGraw-Hill
2	Fundamentals of Internal Combustion Engines	Gupta H.N.,	Latest	Prentice Hall of India
3	Internal Combustion Engines	Mathur& Sharma,	Latest	Dhanpat Rai & Sons
4	Automotive Engines	William H.Crouse,	Latest	McGraw-Hill.
5	Automobile Engineering	Narang G.B.S	Latest	Khanna Publishers, Delhi
6	Course in Automobile Engineering	Sharma R. P.	Latest	Dhanpat Rai & Sons
7	Automobile Engineering Vol-1 and 2	Dr. Kirpal Singh	Latest	Standard Publishers and Distributors Pvt Ltd
Important Web Links				
1	https://nptel.ac.in/courses/112104033/			
2	https://swayam.gov.in/nd1_noc20_me42			
3	http://web.iitd.ac.in/~ravimr/courses/mel345/classification.pdf			

Code: BMECME4103	MANUFACTURING PROCESSES	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the importance of foundry technology and terms related to different casting processes.	L2	PO1, PO3	PSO3
CO – 02	Understand the metal joining fundamentals and different welding techniques.	L2	PO1, PO2	PSO3
CO – 03	Apply metal working, deformation concepts, and forming operations.	L3	PO1, PO2, PO3	PSO3
CO – 04	Understand the concepts of powder metallurgy and rapid prototyping.	L2	PO1, PO3, PO5	PSO2, PSO3
CO – 05	Understand the plastic technology, enabling them to classify plastics, analyze their past, present, and future uses.	L2	PO1, PO2	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**-**	**2**	**-**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**-**	**-**	**3**
CO 2	**2**	**2**	**-**	**-**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**-**	**3**
CO 3	**2**	**1**	**2**	**-**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**-**	**3**
CO 4	**3**	**-**	**1**	**-**	**1**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**1**	**2**
CO 5	**3**	**2**	**-**	**-**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**-**	**2**
WT. AVG	**2.6**	**1.6**	**1.6**		**1**									**2.33**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Foundry Technology	9
2.	Metal Joining Processes	8
3.	Forming and Shaping Processes:	8
4.	Powder Metallurgy	7
5.	Plastic Technology	7

D. DETAILED SYLLABUS

	Unit Details
1.	**Foundry Technology**
	• Introduction of Unit • Importance of manufacturing, Technological definition of manufacturing, Types of production processes. • Foundry Technology: Patterns practices: Types of patterns, allowances and material used for patterns, • Moulding practices**:** Moulding materials, Moulding sands; properties, Green sand moulding, pit and floor moulding, gating system design, and riser design. • Casting practices: Fundamental of metal casting, sand casting, shell-mould casting, investment casting, permanent mould casting, die casting, centrifugal casting, casting defects • Conclusion of Unit including real life applications
2.	**Metal Joining Processes**
	• Introduction of Unit • Metal Joining Processes: Principle of welding, Arc welding, Gas welding and cutting: Processes and equipment. • Resistance welding: principle and equipment; spot and seam welding process. ultrasonic and laser beam welding, electron beam welding and special welding processes; TIG, MIG, friction stir and explosive welding, welding defects. • Conclusion of Unit including real life applications
3.	**Forming and Shaping Processes**
	• Introduction of Unit • Metal working: concept of strain hardening, hot and cold working, rolling, principle and operations, • Forging: forging operations, wire and tube drawing processes. Method of forging. Cold working processes- Shearing, drawing, squeezing, blanking, piercing, deep drawing, coining and embossing. • Sheet Metal working: Presses and their classification, Die & punch and press work methods and processes. Blanking and Piercing. • Conclusion of Unit including real life applications
4.	**Powder Metallurgy**
	• Introduction of Unit. • Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, properties of metal powders, advantages and applications of Powder manufacturing. • Rapid Prototyping Operations: Introduction, subtractive processes, additive processes. • Conclusion of Unit including real life applications
5.	**Plastic Technology**
	• Introduction of Unit • Plastic Technology: Review of plastics, and its past, present & future uses, Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Manufacturing of Plastic components: Injection moulding, compression moulding, transfer moulding. Resins & Adhesives. • Conclusion of Unit including real life application.

E. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Production Technology Volume I & II	P.N. Rao	Latest	Tata McGraw Hill Publication.
2.	Production Technology	R.K. Jain	Latest	Khanna Publishers.

3.	Elements of Workshop Technology Volume I&II	Hajara Choudhari, Bose S.K.	Latest	Asia Publishing House
4.	Production Technology	HMT	Latest	Tata McGraw Hill Publishers
5.	Materials and Process Manufacturing	E. Paul De. Garmo,	Ninth	John Willey Publication
6.	Production Technology	P.C. Sharma	Latest	Khanna Publishers.

Important Web Links	
1	https://nptel.ac.in/courses/112107219/
2	https://nptel.ac.in/courses/112107145/

Code: BMECME4104	FLUID MECHANICS AND FLUID MACHINES	3 Credits [LTP: 3-1-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand properties and behaviors of fluids at rest and forces on submerged and floating bodies.	L2	PO1, PO2	PSO3
CO – 02	Apply principles to describe and analyze fluid flow characteristics.	L3	PO1, PO2, PO5	PSO3
CO – 03	Apply Euler's and Bernoulli's equations to analyze fluid motion in practical applications.	L3	PO1, PO2, PO4, PO5	PSO3
CO – 04	Understand fluid flow in closed conduits, including head losses and boundary layer concepts.	L2	PO1, PO2, PO3, PO4	PSO3
CO – 05	Understand the performance of hydraulic machines like turbines and centrifugal pumps.	L2	PO1, PO2, PO3, PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	—	—	—	—	—	—	—	—	-	—	3
CO 2	3	3	-	-	2	—	—	—	—	—	—	—	—	—	3
CO 3	3	3	-	2	2	—	—	—	—	—	—	—	—	—	3
CO 4	3	3	2	3	-	—	—	—	—	—	—	—	—	—	3
CO 5	3	3	2	-	2	—	—	—	—	—	—	—	—	—	3
WT. AVG	**3.0**	**2.8**	**2.0**	**2.5**	**2.0**										**3.0**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Fluid Statics	08
2	Fluid kinematics	07
3	Fluid dynamics	07
4	Closed conduit flow	07
5	Hydraulic Machines	07

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Fluid Statics**
	● Introduction of Unit ● Properties of fluids, types of fluids including viscosity, compressibility and bulk modulus, surface tension and capillarity, vapour pressure and cavitation; hydrostatic pressure distribution, manometry, forces on submerged bodies, buoyancy and floatation, stability of floating bodies. ● Conclusion and Summary of Unit
2.	**Fluid kinematics**

	● Introduction of Unit ● Types of fluid flow; rate of flow or discharge, continuity equation, continuity equation in three-dimensions, velocity and acceleration; flow description using path line, streamline and streak line, velocity potential function and stream function, vortex flow. ● Conclusion and Summary of Unit
3.	**Fluid dynamics**
	● Introduction of Unit ● Equations of Motion, Euler's Equation of Motion, Bernoulli's Equation from Euler's Equation, Bernoulli's Equation for Real Fluid, Practical Applications of Bernoulli's Equation, Venturimeter, Orifice Meter or Orifice Plate, Pitot-tube, The Momentum Equation, Free Liquid Jets. ● Conclusion of Unit including Real Life Application
4.	**Closed conduit flow**
	● Introduction of Unit ● Dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow. ● Conclusion of Unit including Real Life Application
5.	**Hydraulic Machines**
	● Introduction of Unit ● Impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine, specific speed, unit quantities, centrifugal pumps.

E. RECOMMENDED STUDY MATERIAL:

Sr.No	**Text Book**	**Author**	**Edition**	**Publication**
1.	Fluid Mechanics	F. M. White	Latest	Tata McGraw-Hill
2.	Introduction to Fluid Mechanics	R. W. Fox, A.T. McDonald and P.J. Pritchard	Latest	John Wiley
3.	Hydraulic and Fluid Mechanics	Dr. P.N Modi, Dr. S.M Seth	Latest	Standard Book House.
4.	Fluid Mechanics & Hydraulic Machines	R.K. Bansal	Latest	Luxmi Publication
Sr.No	**Reference Book**	**Author**	**Edition**	**Publication**
1.	Fluid Mechanics	J. F. Douglas, J.M. Gasiorek, J. A. Swaffield and L.B. Jack	2008	Pearson Education
2.	Fluid Mechanics	Y. A. Cengel and J.M. Cimbala	2006	Tata McGraw-Hill
3.	Mechanics of Fluids	M. C. Potter, D. C. Wiggert and B. H. Ramadan	2012	Cengage Learning
Important Web Links:				
1	https://nptel.ac.in/courses/112105206/			
2	en.wikipedia.org/wiki/Fluid Mechanics and Machinery			

Code: BMECME4201	Automobile and IC Engine Lab	1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	**Illustrate** the construction and working of various types of clutches with their application	L3	PO1, PO2, PO3, PO4	PSO1, PSO3
CO2	**Analyze** design aspects of various types of steering system	L4	PO1, PO2, PO3, PO4	PSO1, PSO3
CO3	**Demonstrate** the working of automotive transmission system	L2	PO1, PO2, PO3, PO4	PSO1, PSO3
CO4	**Analyze** various automotive braking system and their application	L4	PO1, PO2, PO3, PO4	PSO1, PSO3
CO5	**Apply** the test on petrol and diesel engine to determine their operating characteristics	L3	PO1, PO2, PO3, PO4	PSO1, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	-	-	-	-	-	-	-	2	-	2
CO2	3	2	1	1	-	-	-	-	-	-	-	-	2	-	2
CO3	3	2	2	1	-	-	-	-	-	-	-	-	2	-	2
CO4	3	2	1	2	-	-	-	-	-	-	-	-	2	-	2
CO5	2	2	1	1	-	-	-	-	-	-	-	-	2	-	2
WT. AVG	**2.6**	**2**	**1.2**	**1.2**	-	-	-	-	-	-	-	-	**2**	-	**2**

C. LIST OF EXPERIMENT

Exp No.	Name of Experiment
1	To study and prepare report on the cut section models of I.C. Engine.
2	Performance Analysis of Four stroke S.I. Engine and C. I. Engine- Determination of indicated and brake thermal efficiency, specific fuel consumption at different loads, Energy Balance.
3	To study the actual valve timing diagram of 4-stroke Petrol Engine and Diesel Engine.
4	To study the Fuel Supply System of S.I. Engines- Carburetor, Fuel Injection Pump and MPFI.
5	To study the Fuel Supply System of C.I. Engines- Injector & Fuel Pump.
6	To study and prepare report on the constructional details, working principles and operation of the Automotive Transmission systems.
7	To study and prepare report on the constructional details, working principles and operation of the Automotive Suspension Systems.
8	To study and prepare report on the constructional details, working principles and operation of the Automotive Steering Systems.
9	To study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
10	To study and prepare report on the constructional details, working principles and operation of Automotive Emission / Pollution control systems.

D. VIRTUAL LABS

Important Web Links	
1	http://vlabs.iitkgp.ernet.in/rtvlas/
2	https://www.iitg.ac.in/mech/lab_ice.php
3	https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2017/labs/

Code: BMECME4202	MANUFACTURING TECHNOLOGY LAB-I	1 Credit [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Perform various joining operations (ARC welding, gas welding, spot welding) to produce strong and defect-free joints.	L2	PO1, PO2, PO3, PO4, PO5	PSO3
CO – 02	Develop sand moulding skills, design and produce wooden patterns, and cast objects using wax and sand moulding techniques.	L3	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 03	Conduct material testing (e.g., permeability test) and interpret results to evaluate moulding sand properties.	L3	PO1, PO2, PO4, PO5	PSO3
CO – 04	Analyze the effects of hot and cold working (forging and bending) on microstructural and mechanical properties of engineering materials.	L3	PO1, PO2, PO3, PO4, PO5	PSO3
CO – 05	Operate and understand basic manufacturing equipment and tooling (lathe, forging, bending, welding) while applying best practices for quality and safety.	L3	PO1, PO3, PO5	PSO3

B. **MAPPING MATRIX OF CO, PO, & PSO**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**3**	**3**	**3**	**2**	—	—	—	—	—	—	—	-	—	**3**
CO 2	**3**	**3**	**3**	-	**3**	—	—	—	—	—	—	—	—	**3**	**3**
CO 3	**3**	**3**	-	**3**	**3**	—	—	—	—	—	—	—	—	—	**3**
CO 4	**3**	**3**	**3**	**2**	**2**	—	—	—	—	—	—	—	—	—	**3**
CO 5	**3**	-	**3**	-	**3**	—	—	—	—	—	—	—	—	—	**3**
WT. AVG	**3**	**3**	**3**	**2.6**	**2.6**									**3**	**3**

C. DETAILED SYLLABUS

1.	To performed five joints in ARC Welding.
2.	To performed Butt joint in gas welding.
3.	Practice to making one job with the help of spot welding
4.	To Making moulding box with the help of various tools.
5.	To making single and double wooden pattern using Lathe machine and tools
6.	To performed any object with the help of WAX casting
7.	To performed permeability test for given sample of mould material.
8.	Study the forging of hot steel and its property changes.

9.	Effect of cold working on hardness and microstructures of metals like Cu.
10.	Study tube bending operation on tubes on different diameters of tubes and calculation of loads.
Virtual Labs	
•	http://sm-nitk.vlabs.ac.in/#
•	https://vlab.amrita.edu/?sub=62&brch=271

Code: BMECME4203	FLUID MECHANICS AND FLUID MACHINES LAB	1 Credit [L T P: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Identify and measure the viscosity of liquids and analyze its variation with temperature.	L2	PO1, PO2, PO5	PSO3
CO – 02	Determine and analyze the metacentric height of a given body and head loss in pipes.	L3	PO1, PO2, PO3, PO5	PSO3
CO – 03	Measure and analyze flow rates using Venturi meter, orifice meter, and nozzle meter, and study laminar and turbulent flow.	L3	PO1, PO2, PO3, PO5	PSO3
CO – 04	Determine the coefficient of friction in pipes and study the momentum equation.	L2	PO1, PO2, PO5	PSO3
CO – 05	Evaluate the performance characteristics of hydraulic machines such as Pelton wheel, Francis turbine, Kaplan turbine, reciprocating pump, and centrifugal pump.	L3	PO1, PO2, PO4, PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	-	—	1	—	—	—	—	—	—	—	—	—	2
CO 2	3	3	2	—	2	—	—	—	—	—	—	—	—	—	3
CO 3	3	3	2	—	2	—	—	—	—	—	—	—	—	—	3
CO 4	3	2	-	—	1	—	—	—	—	—	—	—	—	—	-
CO 5	3	3	-	2	2	—	—	—	—	—	—	—	—	—	3
WT. AVG	**2.8**	**2.6**	**2.0**	**2.0**	**1.6**										**2.7**

C. LIST OF EXPERIMENTS

1	To determine the metacentric height and evaluate the stability of a floating body.
2	To determine the flow rate of water using a Venturi meter and an orifice meter.
3	To find the discharge (C_d), velocity (C_v), and contraction (C_c) coefficients of a sharp-edged orifice.

4	To determine the friction factor and compare it with theoretical models like Darcy-Weisbach.
5	To calculate the minor head loss in a given length of pipe for different flow conditions.
6	To calculate the major head loss in a given length of pipe for different flow conditions.
7	To identify the type of flow (laminar, transition, or turbulent) and determine the critical Reynolds number.
8	To study the efficiency and performance of Pelton wheel turbine under different load conditions.
9	To study the efficiency and performance of Francis turbine under different load conditions.
10	To study the efficiency and performance of Kaplan turbine under different load conditions.

D. VIRTUAL LAB

1	http://www.vlab.co.in/broad-area-mechanical-engineering
2	http://vlabs.iitb.ac.in/vlab/labsme.html
3	http://www.vlab.co.in/participating-institute-iit-kharagpur

Code: BMEEME4111	NON-DESTRUCTIVE TESTING	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Recall the importance of non-destructive testing methods evaluation of products/materials.	L1	PO1, PO4	PSO3
CO – 02	Understand the flaw detection using magnetic particle inspection and eddy current methods.	L2	PO1, PO4	PSO3
CO – 03	Apply the basic testing knowledge of liquid penetrant testing methods for product testing.	L3	PO1, PO2, PO4	PSO3
CO – 04	Understand the various defects occurred in the products during manufacturing through ultrasonic testing.	L2	PO1	PSO3
CO – 05	Understand the appropriate technique and exposure time for a better imaging in radiography testing	L2	PO1	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	-	-	**2**	—	—	—	—	—	—	—	—	-	**3**	-
CO 2	**3**	-	-	**2**	—	—	—	—	—	—	—	—	—	**3**	-
CO 3	**3**	**1**	-	**2**	—	—	—	—	—	—	—	—	—	**3**	-
CO 4	**3**	-	-	-	-	—	—	—	—	—	—	—	—	**3**	-
CO 5	**3**	-	-	-	—	—	—	—	—	—	—	—	—	**3**	-
WT. AVG	**3**	**1**		**2**										**3**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction to Non Destructive Evaluation and Testing	6
2.	Optical Methods and Liquid Penetrant Testing	6
3.	Electro-Magnetic Testing	7
4.	Ultrasonic Testing	8
5.	Radiographic Testing	9

D. DETAILED SYLLABUS

Unit	Unit Details

1.	**Introduction to Non Destructive Evaluation and Testing**
	● Introduction of Unit ● NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization, Relative merits and limitations. ● Conclusion of Unit including Real Life Application
2.	**Optical Methods and Liquid Penetrant Testing**
	● Introduction of Unit ● Optical Methods: holography- Principles and practices of Optical holography, x-ray and electron beam holography techniques ● Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. ● Conclusion of Unit including Real Life Application
3.	**Electro-Magnetic Testing**
	● Introduction of Unit ● Magnetic Particle Inspection – Principle, procedure, Interpretation and evaluation of test indications, Principles and methods of demagnetization ● Eddy Current Testing- Introduction to electrical impedance, principles of eddy current testing, flaw detection using eddy currents ● Conclusion of Unit including Real Life Application
4.	**Ultrasonic Testing**
	● Introduction of Unit ● Ultrasonic Testing- Generation of ultrasonic waves, Horizontal and shear waves, Near field and far field acoustic wave description, Ultrasonic probes- Straight beam, direct contact type, Angle beam, Transmission/reflection type, and delay line transducers, acoustic coupling and media, Transmission and pulse echo methods, A-scan, B-scan, C-scan, F- scan and P-scan modes, Flaw sizing in ultrasonic inspection. ● Conclusion of Unit including Real Life Application
5.	**Radiographic Testing**
	● Introduction of Unit ● Radiographic Methods- Introduction to x-ray radiography, the radiographic process, X-ray and Gamma ray sources, Geometric principles, Factors governing exposure, radio graphic screens, scattered radiation, arithmetic of exposure, radiographic image quality and detail visibility, industrial X-ray films. ● X-Ray Radiography Processes- Fundamentals of processing techniques, process control, the processing room, special processing techniques, paper radiography, and film graininess signal to noise ratio in radiographs. ● Conclusion of Unit including Real Life Application

E. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1	NDT & Evaluation of Materials	J. Prasad & C G K Nair	Latest	Tata McGraw Hill
2	Non Destructive Testing of Materials	V. Jayakumar & K. Elangovan	Latest	Laxmi Publication
3	Radiography in Modern Industry	W. R. Garrett, H. R. Splettstosser, D. E. Titus	1980	Eastman Kodak Company
4	Introduction to the Non-Destructive Testing of Welded Joints	R Halmshaw	1960	Woodhead Publishing Ltd.
Important Web links				
1	https://nptel.ac.in/courses/113106070			
2	https://www.asnt.org/MajorSiteSections/About/Introduction_to_Nondestructive_Testing.aspx			

Code: BMEEME4112	AUTOMATION AND ROBOTICS	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Identify the potential areas for automation and justify the need for automation.	L2	PO1, PO2	PSO2, PSO3
CO – 02	Analyze the automated production lines, transfer lines and inspection methods.	L4	PO1, PO2, PO3	PSO2, PSO3
CO – 03	Explain the law of robotics and classification of robots.	L2	PO1, PO2	PSO2
CO – 04	Classify the various types of sensors and end effectors used in robots.	L2	PO1, PO2	PSO2, PSO3
CO – 05	Apply the control of robots for some specific applications.	L3	PO1, PO2	PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	-	-	-	**1**	—	—	—	—	—	—	—	-	**2**	**2**
CO 2	**2**	**2**	**1**	-	**1**	—	—	—	—	—	—	—	—	**2**	**3**
CO 3	**2**	**1**	-	-	**1**	—	—	—	—	—	—	—	—	**2**	-
CO 4	**3**	**1**	-	-	**1**	—	—	—	—	—	—	—	—	**1**	**2**
CO 5	**2**	**2**	-	-	**1**	—	—	—	—	—	—	—	—	**2**	**2**
WT. AVG	**2.4**	**1.5**	**1**		**1**									**1.8**	**2.25**

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to automation	8
2.	Automated production Lines	8
3.	Robotics	7
4.	Robot sensor and end efforts	8
5.	Robot Control and Applications	7

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Automation**
	• Introduction of Unit • Basic elements of an automated system, advanced automation functions, levels of automation, process industries versus discrete manufacturing industries, FMS. Hardware components for automation and process control, sensors, actuators. Social issues of automation, types of automation, reasons of automation. • Basic elements of fluid power system, advantages and disadvantages of fluid power, application of fluid power. • Pneumatic vs. hydraulics, Advantages and disadvantages of pneumatics and hydraulics. • Conclusion and Summary of Unit
2.	**Automated production Lines**

	• Introduction of Unit • Fundamentals of automated production lines, application of automated production lines, analysis of transfer lines, types of assembly lines, reasons for using automated assembly lines, fundamentals of automated assembly systems, barcode technology, RFID etc. • Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, other optical Inspection Methods. • Conclusion of Unit including real life applications
3.	**Robotics**
	• Introduction of Unit. • History of robots. Definition of robots. Industrial robots, law of robotics. Advantages and disadvantages of robots. Characteristics of an industrial robot, components of an industrial robot. Classification of robots- Robot classification on the basis of co-ordinate system, basics of power supply, basis of method of control, basis of programming method. Robotic safety, maintenance. • Conclusion of Unit including real life applications
4.	**Robot sensor and end efforts**
	• Introduction of Unit. • Types of sensors in robots. Tactile sensor, Proximity sensor (Position sensor), Range sensor, Machine vision sensor, Velocity sensor. • Robot end effectors- End effectors, classification of end effector, gripper, selection of gripper, Types of grippes, Finger gripper, Mechanical grippers. • Conclusion of Unit including real life applications
5.	**Robot Control and Application**
	• Introduction of Unit • Basics of control: open loop- closed loop, Transfer functions. Types and components of a robot, Embedded systems: Microcontroller Architecture, Kinematic Modeling: Translation and Rotation Representation, Coordinate transformation. • Robot capabilities, application of robots, manufacturing applications, material handling applications. • Conclusion of Unit including real life application.

D. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Robotics and Control	Nagrath and Mittal	Latest	Tata McGraw-Hill
2.	Robot Dynamics and Control	Spong and Vidhyasagar	Latest	John Wiley and sons
3.	Introduction to Robotics – Analysis, Systems and Application	Saeed B. Niku	Latest	PHI
4.	Robotics for Engineers	YoramKoren	Latest	McGraw Hill International
5.	Robotic Engineering – An Integrated Approach	Klafter, Chmielewski and Negin	Latest	PHI
Important Web links:				
1	https://nptel.ac.in/courses/112101098/			
2	https://nptel.ac.in/courses/112105249/			

Code: BMEEME4113	MECHATRONICS	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the fundamental concepts and interdisciplinary scope of Mechatronics,	L1	PO1, PO2, PO3	PSO3
CO – 02	Analyze the working principles and applications of various transducers, sensors, and signal conditioning circuits	L2	PO1, PO2	PSO3
CO – 03	Demonstrate the functionality and classification of actuators and mechanisms	L2	PO1, PO2, PO3	PSO3
CO – 04	Compare the architecture and functional differences between microprocessors and programmable logic controllers (PLCs)	L2	PO1	PSO3
CO – 05	Design and evaluate basic control systems using microcontrollers and controllers (P, PI, PD, PID), and illustrate their application in real-time systems.	L3	PO1	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	**1**	-	—	—	—	—	—	—	—	—	-	**3**	-
CO 2	**3**	**2**	-	-	—	—	—	—	—	—	—	—	—	**3**	-
CO 3	**3**	**1**	**2**	-	—	—	—	—	—	—	—	—	—	**3**	-
CO 4	**3**	-	-	-	-	—	—	—	—	—	—	—	—	**3**	-
CO 5	**3**	-	-	-	—	—	—	—	—	—	—	—	—	**3**	-
WT. AVG	**3**	**1.6**	**1.5**											**3**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Basics of Mechatronics	**8**
2.	Data acquisition system	**8**
3.	Actuators and Mechanisms	**8**
4.	Microprocessors	**8**
5.	Microcontrollers	**8**

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Basics of Mechatronics**
	• Introduction to Mechatronics Scope and importance of mechatronics, Key issue, Systems, Measurement systems. • Transducers and Sensors Introduction, Difference between transducer and sensor, Transducer types, Transduction principle, Photoelectric transducers – photoemissive transducers, photoconductive transducers, photovoltaic transducers, Thermistors, Thermodevices, Thermocouple, Inductive transducers, Capacitive transducers. • Conclusion of Unit including real life applications
2.	**Data acquisition system**
	• Introduction of Unit • Signal Conditioning: Introduction, Voltage divider, Rectification, Diode voltage stabilizer, Clipping and Clamping circuit, more about filter circuits, Isolator, Instrumentation amplifier, Bridge circuit, Comparator, Oscillator, Sample and Hold, Clock, Analog to Digital conversion principle, successive approximation method. • Data Presentation and Data Logging Systems: Introduction, Recorders–Graphic recorders, Strip chart recorders, X-Y recorders, Magnetic tape recorder. Data loggers – block diagram description, Data acquisition system – generalized data acquisition system, computer-based data acquisition system. • Conclusion of Unit including real life applications
3.	**Actuators and Mechanisms**
	• Introduction of Unit • Actuators and Mechanisms: Introduction, Actuator types and application areas, Electromechanical actuators, DC Motors – brushed DC motor, brushless, coreless, AC Motors – induction motors, synchronous motors, stepper motor, Fluid power actuators – pneumatic actuators, valves actuators, hydraulic actuators, comparison, Piezoelectric actuators– an illustration, piezoelectric motor, Magnetostrictive actuators, Memory metal actuators. • Conclusion of Unit including real life applications
4.	**Microprocessors**
	• Introduction to Microprocessors and Microcontrollers • Microprocessor–Introduction, Basic element of control systems Microcontrollers – Introduction, Difference between Microprocessors and Microcontrollers Programmable logic controllers – Introduction. • Conclusion of Unit including real life applications
5.	**Microcontrollers**
	• Introduction of Unit • Control Systems and Controllers Introduction, Control system, Open-loop control systems, Closed-loop control systems – notations, reachability, transfer function. The Controllers – on-off controller, proportional controller, integral controller, derivative controller, proportional plus integral controller. Design and evaluate basic control systems using microcontrollers and controllers (P, PI, PD, PID), • Conclusion of Unit including real life applications

E. RECOMMENDED STUDY MATERIAL:

Sr. No.	Reference Book	Author	Edition	Publication
1	Mechatronics	J.G. Joshi	Latest	Prentice Hall of India

2	Mechatronics	HMT Limited	Latest	Tata McGraw-Hill
3	Mechatronics	R.P. Borole	Latest	Nirali Prakashan, Jalgaon
4	Mechatronics	N.P. Mahalik	Latest	Tata McGraw-Hill
5	Mechatronics	W. Bolton	Latest	Pearson Education
6	Applied Mechatronics	A. Smaili	Latest	Oxford University Press
7	Introduction to Mechatronics	D.R. Appukuttan	Latest	Oxford University Press
Important Web links				
1	https://nptel.ac.in/courses/112103174/			
2	https://nptel.ac.in/content/syllabus_pdf/112103174.pdf			

Code: BUACHM4224	HUMAN VALUES AND PROFESSIONAL ETHICS	2 Credits [LTP: 0-0-

A. COURSE OUTCOMES: After Successful completion of the course students will be able

CO	At the end of this course, learners will be able to:	Bloom Level
CO – 01	Learn how to update and manage the experience, education, and skills & expertise sections on social media & formulate appropriate updates as a means to promote business activities.	**L3**
CO – 02	Understand how to leverage grammar and formatting in formal documents & demonstrate how to follow the stages of the writing process.	**L3**
CO – 03	Evaluate presentation's weak spots and areas for improvement & learn, practice and acquire the skills necessary to deliver effective presentation with clarity and impact.	**L5**
CO – 04	Evaluate basic factors such as personal skills & abilities, career fields, willingness to learn and strengthen the chances to get desirable jobs.	**L5**
CO – 05	Understand negotiation and team skills dynamics and how to prepare for uncertainty & learn to craft agile strategy and be quick on your feet in changing circumstances.	**L3**

B. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Personal Branding	2
2.	Professional Writing-II	8
3.	Presentation Skills: Professional Setting	2
4.	Job Interview & Group Discussion: Preparation by Mock Practice	4
5.	Negotiation Skills, Team Management & Professional Awareness	8

C. DETAILED SYLLABUS

LIST OF LABS	
1.	Definition of communication, communication process, informal communication, non-verbal, speakers vs communicators
2.	How leaders communicate, skills of a good communicator,
3.	40 question self-assessment, making sure your message matters, choosing your words, improving your skills
4.	Definition of defensive/non-defensive communication & 5 skills for communicating non- defensively.
5.	Definition of feedback, giving feedback, 10 common feedback mistakes, 5 tips on receiving feedback, 10 tips for dealing with difficult people.
6.	Barriers to listening, what is listening, listening vs hearing, bad listening habits, active listening
7.	Advanced Group Discussion-II: Analysis of professional GD Videos and Practices on Topics/Video/Article based topics
8.	When to use/not use e-mail, e-mail etiquette, when to use/not use telephone and video conferencing, 7-tips on telephone etiquette
9.	Planning your presentation, building, audio-visual aids, giving presentation, audience rapport overcoming stage fright.

10.	Team Building Strategies: Project Management

D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO – 01	2	2	-	-	3	2	1	2	3	3	-	2
CO – 02	3	3	-	2	-	1	-	1	2	3	-	1
CO – 03	2	2	1	2	2	2	-	2	3	3	1	2
CO – 04	2	2	2	2	-	3	2	1	2	2	2	3
CO – 05	2	2	2	3	3	3	3	3	3	3	3	3

E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3
CO – 01	2	3	2
CO – 02	3	2	1
CO – 03	2	3	2
CO – 04	2	2	3
CO – 05	3	3	3

Note: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

Code: BULCSE4202	Skill Enhancement technical Course-I	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the initial settings and different coordinate system of Solid Works Modeling Software on 3D-Part modeling components.	L2	PO1, PO3, PO5	PSO2
CO – 02	Apply the commands on 3D – Part modeling of the components.	L3	PO1, PO3. PO5	PSO2
CO – 03	Apply the modification and manipulation in 3D Modeling using Solid Works modeling software.	L3	PO1, PO3, PO5	PSO2
CO – 04	Create the detailing & annotation in 3D Modelling using Solid Works modeling software.	L6	PO1, PO3, PO5	PSO2
CO – 05	Apply the different editing commands on sheet metal in 3D using Solid Works modeling software.	L3	PO1, PO3, PO5	PSO2

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**-**	**1**	**-**	**3**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**-**	**3**	
CO 2	**2**	**-**	**3**	**-**	**3**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**—**	**2**	
CO 3	**2**	**-**	**2**	**-**	**2**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**—**	**3**	
CO 4	**3**	**-**	**2**	**-**	**3**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**—**	**3**	
CO 5	**2**	**-**	**2**	**-**	**2**	**—**	**—**	**—**	**—**	**—**	**—**	**2**	**—**	**2**	
WT. AVG	**2.6**	**-**	**2**		**2.6**							**2**		**2.6**	

C. LIST OF EXPERIMENTS

1	Learn the basic initial setting and viewing of the 3D Modeling software's interface.
2	Understand different coordinate system and do a exercise.
3	Learn 3-D Modeling and draw basic mechanical components.
4	Learn and use of 3-D Advanced Modeling.
5	Feature Modification and Manipulation in 3D Modeling.

6	Learn and draw the basic entities in 2D Drafting with an example of machine element.
7	Learn and use of Detailing & Annotation.
8	Draw the different Surface model with different editing commands.
9	Learn and use of Sheet Metal with different editing commands.
10	Learn and use shading and rendering techniques for better visual appearance.

Code: BUACHM4224	HUMAN VALUES AND PROFESSIONAL ETHICS	2 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES: After Successful completion of the course students will be able

CO	At the end of this course, learners will be able to:	Bloom Level
CO – 01	Learn how to update and manage the experience, education, and skills & expertise sections on social media & formulate appropriate updates as a means to promote business activities.	L3
CO – 02	Understand how to leverage grammar and formatting in formal documents & demonstrate how to follow the stages of the writing process.	L3
CO – 03	Evaluate presentation's weak spots and areas for improvement & learn, practice and acquire the skills necessary to deliver effective presentation with clarity and impact.	L5
CO – 04	Evaluate basic factors such as personal skills & abilities, career fields, willingness to learn and strengthen the chances to get desirable jobs.	L5
CO – 05	Understand negotiation and team skills dynamics and how to prepare for uncertainty & learn to craft agile strategy and be quick on your feet in changing circumstances.	L3

B. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Personal Branding	2
2.	Professional Writing-II	8
3.	Presentation Skills: Professional Setting	2
4.	Job Interview & Group Discussion: Preparation by Mock Practice	4
5.	Negotiation Skills, Team Management & Professional Awareness	8

C. DETAILED SYLLABUS

LIST OF LABS	
1.	Definition of communication, communication process, informal communication, non-verbal, speakers vs communicators
2.	How leaders communicate, skills of a good communicator,
3.	40 question self-assessment, making sure your message matters, choosing your words, improving your skills
4.	Definition of defensive/non-defensive communication & 5 skills for communicating non- defensively.
5.	Definition of feedback, giving feedback, 10 common feedback mistakes, 5 tips on receiving feedback, 10 tips for dealing with difficult people.
6.	Barriers to listening, what is listening, listening vs hearing, bad listening habits, active listening
7.	Advanced Group Discussion-II: Analysis of professional GD Videos and Practices on Topics/Video/Article based topics
8.	When to use/not use e-mail, e-mail etiquette, when to use/not use telephone and video conferencing, 7-tips on telephone etiquette
9.	Planning your presentation, building, audio-visual aids, giving presentation, audience rapport overcoming stage fright.
10	Team Building Strategies: Project Management

D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO – 01	2	2	-	-	3	2	1	2	3	3	-	2
CO – 02	3	3	-	2	-	1	-	1	2	3	-	1
CO – 03	2	2	1	2	2	2	-	2	3	3	1	2
CO – 04	2	2	2	2	-	3	2	1	2	2	2	3
CO – 05	2	2	2	3	3	3	3	3	3	3	3	3

E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3
CO – 01	2	3	2
CO – 02	3	2	1
CO – 03	2	3	2
CO – 04	2	2	3
CO – 05	3	3	3

Note: On the basis of mapping of COs with POs, this course is related to Employability / Skill Development

FIFTH SEMESTER

Code: BMECME5101	Theory of Machine	3 Credits[LTP:3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Analyze the various kinematics links and mechanisms.	L3	PO1, PO2	PSO1
CO – 02	Identify the governing and gyroscopic couple effect on vehicle.	L3	PO1, PO2, PO5	PSO1, PSO2
CO – 03	Explain the gear, gear trains and their applications.	L3	PO1, PO2, PO4, PO5	PSO1, PSO2
CO – 04	Understand modelling of vibrating systems in undamped free vibration of single degree freedom systems.	L2	PO1, PO2, PO3, PO4	PSO1, PSO3
CO – 05	Understand the concept of critical damping and its importance in damped free vibration of single degree freedom system	L2	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	—	—	—	—	—	—	—	—	3	-	-
CO 2	3	3	-	-	2	—	—	—	—	—	—	—	3	2	-
CO 3	3	3	-	2	2	—	—	—	—	—	—	—	3	2	-
CO 4	3	3	2	3	-	—	—	—	—	—	—	—	3	-	2
CO 5	3	3	2	-	2	—	—	—	—	—	—	—	3	-	2
WT. AVG	**3.0**	**2.8**	**2.0**	**2.5**	**2.0**								**3.0**	**2.0**	**2.0**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Fundamentals of Kinematics	08
2	Friction devices and clutches	07
3	Gears	07
4	Undamped free vibration	07
5	Damped free vibration	07

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Fundamentals of Kinematics**

	• Introduction of Unit • Introduction to mechanism: Basic concept of machines, link, kinematic pairs, kinematic chain, and mechanism. Inversions of kinematic chains: four bar chain mechanism, quick return mechanisms, inversions of double slider crank mechanisms. Velocity and acceleration in mechanism: velocity and acceleration polygons, relative velocity and instantaneous centre method. Cams: Types of cams- displacement, velocity and acceleration curves for different cam followers, consideration of pressure angle and wear. • Conclusion and Summary of Unit.
2.	**Mechanisms for Control**
	• Introduction of Unit • Governor: a) Types of governors – Watts, Porter, Proell, Hartnell governor, and spring-controlled governors b) Sensitiveness of governors, c) Hunting, Isochronisms, stability, d) Effect of governor, e) Power of governor, controlling force. • Gyroscope: Principle of gyroscopic couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilization of sea vessels. • Conclusion of Unit including Real Life application.
3.	**Gears**
	• Introduction of Unit • Spur Gears: -Law of gearing & Terminology used in gears, conjugate action, in volute and cycloidal profile, path of contact, arc of contact, contact ratio, interference, undercutting, methods to avoid undercutting and interface, gear standardization, effect of center distance variation on the velocity ratio for involute profile tooth gears. • Gear Trains: - Simple, compound and epicyclic gear trains. Analytical and graphical method for velocity ratio. • Conclusion of Unit including Real Life application
4.	**Undamped free vibration of single degree freedom systems**
	• Introduction of Unit • Undamped free vibration of single degree freedom systems: Modelling of Vibrating Systems, Evaluation of natural frequency–differential equation, Energy & Rayleigh's methods, Equivalent systems. • Conclusion of Unit including Real Life Application
5.	**Damped free vibration of single degree freedom systems**
	• Introduction of Unit • Damped free vibration of single degree freedom systems: Different types of damping, Concept of critical • Damping and its importance, study of vibration response of viscous damped systems for cases of under damping, critical damping • Conclusion of Unit including Real Life Application

E. RECOMMENDEDSTUDYMATERIAL:

Sr.No	ReferenceBook	Author	Edition	Publication
1.	Theory of Machine"	Khurmi,R.S.,Gupta,J.K.	Latest	S.Chand.
2.	Theory of Machines and Mechanisms	Shigley J.E. and Uicker J.J.	Latest	McGraw Hill,Inc.
3.	Theory of Machines	Rattan S. S.	Latest	Tata McGraw Hill.
4.	Theory of Machines	BallaneyP.L.	Latest	Khanna Publishers, Delhi.
5.	Mechanism and Machine Theory	Rao,J.S., and Dukkipati,R.V.	Latest	Wiley Eastern Ltd.
6.	Kinematics and Linkages Design	HallA.S.	Latest	Prentice-Hall.
ImportantWebLinks				
1	https://nptel.ac.in/courses/11210412/			
2	https://nptel.ac.in/courses/11210411/			

Code: BMECME5102	MANUFACTURING SCIENCE AND TECHNOLOGY	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Illustrate the functioning of single point cutting tool and aspects.	L2	PO1, PO2	PSO3
CO – 02	Analyze the mechanical measuring tools and their functioning.	L4	PO1, PO2	PSO3
CO – 03	Examine the importance of CNC machine and its advantages and limitation.	L2	PO1, PO2	PSO3
CO – 04	Apply the design of lathe bed and its strength constraint.	L3	PO1, PO2	PSO3
CO – 05	Analyze the finishing processes and High Velocity Forming Methods.	L4	PO1, PO2, PO3	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**1**	-	-	**1**	—	—	—	—	—	—	—	-	-	**3**
CO 2	**3**	**2**	-	-	**1**	—	—	—	—	—	—	—	—	-	**2**
CO 3	**3**	**2**	-	-	**1**	—	—	—	—	—	—	—	—	-	**3**
CO 4	**2**	**2**	-	-	**1**	—	—	—	—	—	—	—	—	-	**3**
CO 5	**2**	**2**	**1**	-	**1**	—	—	—	—	—	—	—	—	-	**3**
WT. AVG	**2.8**	**1.8**	**1**		**1**										**2.8**

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1	Theory of Metal Cutting	9
2	Precision Methods	8
3	Numerical Control of Machine Tools	8
4	Design of Machine Tool Element	8
5	Finishing Processes and High Velocity Forming Methods	8

D. DETAILED SYLLABUS

Unit	Unit Details
1	**Theory of Metal Cutting**
	• Introduction of Unit • **Theory of Metal Cutting**, Mechanics of chip formation single point cutting tool, method of machining, type of chips, determination of shear angle, undeformed chip thickness, force relation, energy considerations in metal cutting, tool wear and tool life, tool material. • **Design of Single Point Cutting Tools:** Introduction; functions of various tool angles; design of single point turning tool; Parting tool; empirical determination of force components. • Conclusion of Unit including Real Life application
2	**Precision Methods**

	• Introduction of Unit • **Precision Measurement and Instruments:** Standards of linear measurements and angular measurements; screw thread measurement; measurement of effective diameter; Gear measurement, measurement of tooth profile, tooth thickness and pitch, measurement of surface roughness, Comparators types. • **Jigs and Fixtures: -**Introduction, definition and difference; usefulness of jigs and fixtures; materials used; principles and methods of location; clamping elements; assembly fixtures. • Conclusion of Unit including Real Life application
3	**Numerical Control of Machine Tools**
	• Introduction of Unit • **Numerical Control of Machine Tools**; Introduction, Numerical Control & its growth, NC Machines tools, Axes of NC Machines, Classification of NC System, CNC, DNC and Machining Centre. Machine Control unit, NC tools and Tool changer. Manual Part Programming; coordinate, Feed, Speed & Tool. • Conclusion of Unit including Real Life application
4	**Design of Machine Tool Element**
	• Introduction of Unit • **Design of Lathe bed**, Material and construction feature, various bed section, designing for torsional rigidity, Theoretical aspect of design of guide ways. • **Press Tool Design**: Introduction, press operation, classification of power presses, Press selection, press working terminology, working of cutting die. • Conclusion of Unit including Real Life application
5	**Finishing Processes and High Velocity Forming Methods**
	• Introduction of Unit • **Finishing Processes: -** Principle of operation, advantages, limitations and applications of: Grinding, Honing, Lapping, Buffing, Burnishing, Polishing. • **High Velocity Forming Methods:** Hydraulic forming, Explosive forming, Electro-hydraulic forming, Magnetic pulse forming • Conclusion of Unit including Real Life application

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Book	Author	Edition	Publication
a. Reference Books				
1.	Manufacturing Process I & II -	Bawa,	Latest	Tata McGraw Hill Publication
2.	Materials and Process Manufacturing.	E. Paul DeGarmo, J.T. Black, Ronald A. Kohser,	Latest	John Willey Publication Ninth edition
3.	Jig and Fixture Design	Erik K. Henriksen	Latest	Manual - Industrial Press
4.	Tool Design	Donaldson, Lecain, Goold	Latest	Tata McGraw Hill
5.	A Textbook of Production Engineering	P. C. Sharma	Latest	S. Chand & Company. Ltd.
6.	CAD/CAM	Grover M. P.	Latest	Tata McGraw hill Publication
7.	Advanced Machining Processes	V. K. Jain	Latest	Allied Publication
b. Important Web links				
1	https://nptel.ac.in/courses/112107144/			
2	https://en.wikipedia.org/wiki/Manufacturing Science and Technology			

Code: BMECME5103	POWER PLANT ENGINEERING	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	To create awareness about various sources of energy, working of thermal power plants and combustion process	L1	PO1, PO2, PO3	PSO3
CO – 02	To understand how gas and steam power plants are functioning	L2	PO1, PO2	PSO3
CO – 03	To understand how power is achieved nuclear power plant, their safety measures	L2	PO1, PO2, PO3	PSO3
CO – 04	Able to learn about renewable sources of energy and functions of hydroelectric power plants.	L2	PO1	PSO3
CO – 05	To apply the concepts of economics in power plants	L3	PO1	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	**1**	**-**	—	—	—	—	—	—	—	—	**-**	**3**	**-**
CO 2	**3**	**2**	**-**	**-**	—	—	—	—	—	—	—	—	—	**3**	**-**
CO 3	**3**	**1**	**2**	**-**	—	—	—	—	—	—	—	—	—	**3**	**-**
CO 4	**3**	**-**	**-**	**-**	**-**	—	—	—	—	—	—	—	—	**3**	**-**
CO 5	**3**	**-**	**-**	**-**	—	—	—	—	—	—	—	—	—	**3**	**-**
WT. AVG	**3**	**1.6**	**1.5**											**3**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction of Power Plant Engineering	8
2.	Gas and steam Power Plants	9
3.	Nuclear Power Plants	7
4.	Renewable Energy Power Plants	9
5.	Economics of Power Plant Engineering	7

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction of Power Plant Engineering**
	● Introduction to Unit ● Improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers Steam & Heat rate, Subsystems of thermal power plants Conclusion of Unit including real life applications ● Fuel and ash handling, Draught system, Feed water treatment, Binary Cycles and Cogeneration systems ● Conclusion of Unit including real life applications
2.	**Gas and steam Power Plants**

	• Introduction of Unit • Brayton Cycle, Analysis & Optimization, Components of Diesel and Gas Turbine power plants. • Rankine cycle, modified Rankine cycle, P-v, T-s and h-s diagram • Combined Cycle Power Plants, Integrated Gasifier based Combined Cycle systems • Conclusion of Unit including real life applications
3.	**Nuclear Power Plants**
	• Introduction of Unit • Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors, Boiling Water Reactor, (BWR), Pressurized Water Reactor (PWR), Canada Deuterium- Uranium reactor (CANDU), Breeder, Gas, Cooled and Liquid Metal Cooled Reactors, Safety measures for Nuclear Power plants • Conclusion of Unit including real life applications
4.	**Renewable Energy Power Plants**
	• Introduction to unit • Introduction to Renewable Energy Power Plants: Overview of renewable sources with a focus on solar and wind-based power generation. • Solar Power Plants: Working principle, components (PV modules, inverters, etc.), types, and grid integration. • Wind Power Plants: Structure, operation of wind turbines, types of wind farms, and power generation process. • Conclusion of Unit including real life applications
5.	**Economics of Power Plant Engineering**
	• Introduction of Unit • Introduction to Power Plant Economics: Basic economic principles related to energy production and cost analysis. • Economic Analysis of Solar Power Plants: Capital cost, operating cost, payback period, and levelized cost of energy (LCOE). • Economic Analysis of Wind Power Plants: Cost components, capacity factor, return on investment, and financial viability assessment. . • Conclusion of Unit including real life applications

E. RECOMMENDED STUDY MATERIAL:

S. No	Book	Author	Edition	Publication
Reference Books				
1.	Power Plant Engineering	P. K. Nag	Latest	McGraw-Hill
2.	A textbook of power plant engineering	R. K. Rajput	Latest	Laxmi Publications
3.	Power Plant Engineering	Manoj Kumar Gupta	Latest	PHI Learning
4.	Gas Dynamics	V. Ganesan	Latest	McGraw-Hill
5.	Power Plant Engineering	G.R.Nagpal	Latest	Khanna Publishers
Important Web Links				
•	https://elearn.nptel.ac.in/shop/nptel/power-plant-engineering/?v=c86ee0d9d7ed			
•	https://nptel.ac.in/courses/112103421			

Code: BMECME5104	HEAT AND MASS TRANSFER	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the mechanisms of heat transfer, and analyze heat conduction through various materials.	L2	PO1, PO2	PSO3
CO – 02	Apply principles of heat transfer from extended surfaces (fins) and analyze transient heat conduction using the lumped capacitance method.	L3	PO1, PO3, PO5	PSO3
CO – 03	Understand forced and natural convection heat transfer mechanisms, including boundary layer concepts and empirical relations for different geometries.	L2	PO1, PO2, PO4, PO5	PSO3
CO – 04	Understand different types of heat exchangers, their performance, and effectiveness using mean temperature difference and N.T.U. method.	L2	PO1, PO2, PO3, PO4	PSO3
CO – 05	Understand radiative heat transfer principles and apply Fick's law to analyze mass transfer processes.	L3	PO1, PO2, PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	–	–	–	–	–	–	–	–	–	–	3
CO 2	2	3	-	-	2	–	–	–	–	–	–	–	–	–	3
CO 3	3	3	-	2	2	–	–	–	–	–	–	–	–	–	3
CO 4	3	3	2	3	-	–	–	–	–	–	–	–	–	–	3
CO 5	3	3	-	-	2	–	–	–	–	–	–	–	–	–	3
WT. AVG	**3.0**	**2.8**	**2.0**	**2.5**	**2**										**3.0**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Basics of Heat	08
2	Fins and Transient Conduction	06
3	Forced Convection and Natural Convection	08
4	Heat Exchanger	06
5	Thermal Radiation and Mass Transfer	08

D. DETAILED SYLLABUS

Unit	Unit Details

1.	**Basics of Heat and Mass Transfer**
	• Introduction of Unit • **Introduction to Heat Transfer:** Concepts of the mechanisms of heat flows; Conduction, convection and radiation; Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism. **Fourier's law of heat conduction:** Thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. **Conduction:** General 3-Dimensoinal conduction equation in Cartesian; different kinds of boundary conditions; nature of differential equations; one dimensional heat conduction with and without heat generation; heat conduction through composite walls; critical thickness of insulation. • Conclusion of Unit including Real Life application
2.	**Fins and Transient Conduction**
	• Introduction of Unit • **Fins:** Heat transfer from extended surfaces, Types of fins, governing equation, Fin performance, fin efficiency, fin effectiveness, overall fin effectiveness. Fins of uniform cross-sectional area. • **Transient Conduction:** Transient heat conduction; Lumped capacitance method. • Conclusion of Unit including Real Life application
3.	**Forced Convection and Natural Convection**
	• Introduction of Unit • **Forced Convection:** Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Flow over a flat plate; Flow across a single cylinder and a sphere. • **Natural Convection:** Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for natural convection over vertical plates and cylinders, horizontal plates and cylinders. • Conclusion of Unit including Real Life application
4.	**Heat Exchanger:**
	• Introduction of Unit • **Heat Exchanger:** Different types of heat exchangers, arithmetic and logarithmic mean temperature differences, heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger, N.T.U. method. • Conclusion of Unit including Real Life application
5.	**Thermal Radiation and Mass Transfer**
	• Introduction of Unit • Thermal Radiation: Basic radiation concepts, Plank distribution law, Krichoff's law; Wein's displacement law, Stefan Boltzmann law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. • Mass Transfer:- Introduction, Modes of Mass transfer, Concentrations, Velocities and fluxes, Concentrations, Fick's Law. Conclusion of Unit including Real Life application

E. RECOMMENDED STUDY MATERIAL:

Sr. No.	Book	Author	Edition	Publication
Reference Books				
1.	Heat Transfer	S.P. Sukhatme,	2019	Universities Press (India)
2.	Heat and Mass Transfer	R.K. Rajput	Latest	S.Chand& Company Ltd
3.	Heat and Mass Transfer	D.S.Kumar	Latest	S.K.Kataria& Sons
4.	Heat Transfer	J.P. Holman,	2019	McGraw Hill,
5.	Heat and Mass Transfer	E.R.G. Eckert and Robert M. Drake	Latest	McGraw Hill,
6.	Fundamentals of Heat and Mass transfer	Kothandraman. C.P.,	2019.	New Age International
Important Web Links				
1	https://nptel.ac.in/courses/112108149/			
2	https://nptel.ac.in/courses/112101097/			

Code: BMECME5201	MANUFACTURING TECHNOLOGY LAB-II	1 Credit [LTP: 1-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Perform orthogonal and oblique machining operations on the lathe and compute machining times.	L5	PO1, PO2, PO3, PO4	PSO3
CO – 02	Perform belt/thread making and gear cutting operations for precision machining.	L3	PO1, PO2, PO3, PO4	PSO3
CO – 03	Identify and apply the correct tool angles, jigs, and fixtures required for machining.	L3	PO1, PO2, PO3, PO4	PSO3
CO – 04	Operate tool grinders and shaping machines, determining shear angles and machining characteristics.	L5	PO1, PO2, PO3, PO4	PSO3
CO – 05	Measure dimensions precisely using vernier calipers, vernier height gauges, and micrometers.	L5	PO1, PO2, PO3, PO4	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	**2**	**2**	–	–	–	–	–	–	–	–	–	–	**3**
CO 2	**3**	**2**	**2**	**2**	–	–	–	–	–	–	–	–	–	–	**3**
CO 3	**3**	**2**	**2**	**2**	–	–	–	–	–	–	–	–	–	–	**3**
CO 4	**3**	**2**	**2**	**2**	–	–	–	–	–	–	–	–	–	–	**3**
CO 5	**3**	**2**	**2**	**2**	–	–	–	–	–	–	–	–	–	–	**3**
WT. AVG	**3**	**2**	**2**	**2**	–	–	–	–	–	–	–	–	–	–	**3**

C. LIST OF EXPERIMENTS

1	Study and Practice of Orthogonal & Oblique Cutting on a Lathe.
2	Machining time calculation and comparison with actual machining time while cylindrical turning.
3	Belt (thread) making on Lathe machine.
4	Gear cutting on Milling machine.
5	Study of different types of tools and their angles & materials.
6	Experiment on jigs/Fixtures and their uses.
7	Tool grinding (to provide tool angles) on tool-grinder machine.
8	Shear-angle determination (using formula) with tube cutting (orthogonal) on lathe machine.
9	Machining a block on shaper machine.
10	Measurement of Length, Height, and Diameter by Vernier Calipers, Vernier Height Gauge, and Micrometer.

Code: BMECME5202	Theory of Machine and Vibration Lab	1 Credit [LTP:0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (COs)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Analyze the different types of kinematic mechanism like four bar etc.	L2	PO1, PO2, PO5	PSO1, PSO3
CO – 02	Apply the concept of slip and measure the slip of the belt drive.	L3	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3
CO – 03	Understand the characteristic curves of governors and gyroscopic principle.	L2	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3
CO – 04	Analyze gear box types and epicyclic gear train torque transmitted and holding torque	L3	PO1, PO2, PO5	PSO2, PSO3
CO – 05	Analyze and perform the static and dynamic balancing of a rotor.	L3	PO1, PO2, PO4, PO5	PSO1, PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	-	–	1	–	–	–	–	–	–	–	2	-	1
CO 2	3	3	2	–	2	–	–	–	–	–	–	–	3	2	2
CO 3	3	3	2	–	2	–	–	–	–	–	–	–	3	3	2
CO 4	3	2	-	–	1	–	–	–	–	–	–	–	-	3	2
CO 5	3	3	-	2	2	–	–	–	–	–	–	–	3	3	2
WT. AVG	**2.8**	**2.6**	**2.0**	**2.0**	**1.6**								**2.7**	**2.7**	**1.8**

C. LIST OF EXPERIMENTS

1	To study inversion of four bar mechanism and quick return motion mechanism.
2	To perform characteristics of a Watt/ Porter governor.
3	To study and perform the gyroscopic effect principle through models.
4	To study various cam-follower arrangements.
5	To study the epicyclic gear train.
6	To determine the radius of gyration of a given bar by using bi-filer suspension.
7	To verify the relation of a simple pendulum.
8	To determine natural frequency of spring mass system.
9	To determine natural frequency of single rotor system.
10	To verify Dunkerley's rule.

D. VIRTUALLAB

VirtualLabs	
•	http://mm-nitk.vlabs.ac.in/exp1/index.html#
•	http://mm-nitk.vlabs.ac.in/exp7/index.html
•	http://mm-nitk.vlabs.ac.in/exp9/index.html

Code: BMECME5203	Thermal Engineering Lab	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Apply experimental methods to determine thermal conductivity of solids, liquids, and insulating materials.	L1	PO5	PSO3
CO – 02	Analyze heat transfer performance in extended surfaces and natural convection setups to determine temperature distribution and heat transfer coefficients.	L2	PO2,PO4,PO5	PSO3
CO – 03	Evaluate surface radiation properties by measuring emissivity and determining the Stefan-Boltzmann constant.	L2	PO2,PO4,PO5	PSO3
CO – 04	Understand and compare the concepts of LMTD and effectiveness in heat exchangers through parallel and counter flow setups.	L4	PO4	PSO3
CO – 05	Identify and describe the components of steam boilers and calorimeters, and interpret their roles in thermal systems.	L3	PO1,PO3,PO4,PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-		**2**	—	—	—	—	—	—	—	-	—	**3**
CO 2	-	**3**	-	**2**	**2**	—	—	—	—	—	—	—	—	—	3
CO 3	-	**2**	-	**3**	**2**	—	—	—	—	—	—	—	—	—	3
CO 4	-	-	-	**3**	-	—	—	—	—	—	—	—	—	—	3
CO 5	**2**	-	**2**	**2**	**2**	—	—	—	—	—	—	—	—	—	3
WT. AVG	**2**	**2.5**	**2**	**2.5**	**2**										**3**

C. LIST OF EXPERIMENTS

1	To Determine Thermal Conductivity of Insulating Powders.
2	To Measure the thermal Conductivity of Liquid.
3	To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
4	To Determine the transfer Rate & Temperature Distribution for a Pin Fin.
5	To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.
6	To Measure the Emissivity of the Test plate Surface.
7	To Determine Stefan Boltzmann Constant of Radiation Heat Transfer.

8	To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
9	To study various types of Boilers (Steam generators) and to study Boiler mounting and accessories
10	Determination of calorific value using gas calorimeter or Bomb calorimeter.

Virtual Labs	
•	https://ht-nitk.vlabs.ac.in/

Code: BMECME5204	Computer Aided Design LAB - II	1 Credits [LTP: 0-0-1]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the Inventor interface and develop 2D sketches with appropriate constraints and dimensions.	L2	PO1	PSO2
CO – 02	Create and modify 3D parts using standard and advanced modeling features.	L3	PO1, PO5	PSO2
CO – 03	Assemble multiple components with proper constraints and simulate mechanical motion.	L4	PO1, PO3, PO5	PSO2
CO – 04	Generate 2D drawings from 3D models with annotations, dimensions, and views as per engineering standards.	L4	PO1, PO2, PO5	PSO2
CO – 05	Apply parametric design and sheet metal techniques to create intelligent and manufacturable components.	L5	PO1, PO3, PO5	PSO2

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	–	–	–	–	–	–	–	–	–	–	–	–	**3**	–
CO 2	**3**	–	–	–	**3**	–	–	–	–	–	–	–	–	**3**	–
CO 3	**3**	–	**2**	–	**3**	–	–	–	–	–	–	–	–	**3**	–
CO 4	**3**	**3**	–	–	**3**	–	–	–	–	–	–	–	–	**3**	–
CO 5	**3**	–	**2**	–	**3**	–	–	–	–	–	–	–	–	**3**	–
WT. AVG	**3**	**3**	**2**	–	**3**	–	–	–	–	–	–	–	–	**3**	–

C. LIST OF EXPERIMENTS

1.	Introduction to Autodesk Inventor Interface and Navigation
2.	2D Sketching and Applying Geometric & Dimensional Constraints
3.	Creating 3D Models Using Extrude, Revolve, Sweep, and Loft
4.	Part Modification: Fillet, Chamfer, Shell, and Draft Features
5.	Creating Holes, Threads, Patterns, and Mirror Features
6.	Basic Assembly of Components Using Constraints and Joints

7.	Creating 2D Drawings from 3D Models (Drafting & Detailing)
8.	Parametric Modeling Using User Parameters and Equations
9.	Sheet Metal Design and Generating Flat Patterns
10.	Mini Project: Design and Animate a Simple Mechanical Mechanism

D. RECOMMENDED STUDY MATERIAL:

Virtual Labs	
1	http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/labs/exp1/index.php
2	http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/labs/exp3/index.php
3	http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/labs/exp2/index.php
4	http://vlabs.iitb.ac.in/vlabs-dev/labs/oops/labs/exp5/index.php

Code: BMEEME5111	Industrial Engineering	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	**Define** and apply productivity concept to engineering applications	L1	PO1, PO2, PO11, P12	PSO2, PSO3
CO2	**Demonstrate** techniques to increase productivity	L2	PO1, PO2, PO11	PSO2, PSO3
CO3	**Describe** the implementation of work and time study at a workplace	L2	PO1, PO2, PO5, PO11	PSO2, PSO3
CO4	**Assess** the importance of ergonomics for design of machines	L5	PO1, PO2, PO5, PO11	PSO2, PSO3
CO5	**Apply** the concepts of aesthetics at interiors and exteriors of a workplace	L3	PO1, PO2, PO11, P12	PSO2, PSO3

B. MAPPING MATRIX OF CO,PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	2	2	-	2	2
CO2	2	3	-	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	-	-	2	-	-	-	-	-	2	-	-	2	2
CO4	2	3	-	-	2	-	-	-	-	-	2	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	2	2	-	2	2
WT. AVG	**2.2**	**2.6**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2.2**	**2**	**-**	**2**	**2**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Productivity and Work Study	7
2.	Quality and Inventory Control	8
3.	Production Planning & Control	7
4.	Manufacturing Cost Analysis	7
5.	Plant Layout and Material Handling	7

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Productivity and Work Study**
	• Introduction of Unit • **Productivity**: Introduction, definition, various method of measurement, factors effecting productivity, strategies for improving productivity. • **Work Study**: Objectives, Method study, Principle of motion economy, Techniques of method study - Various charts, THERBLIGS, Work measurement - various methods, time study, determining time, Work sampling, Simple Numerical. ● Conclusion of Unit including Real Life Application
2.	**Quality and Inventory Control**
	• Introduction of Unit • **Quality control**: Definition of quality, Various approaches, Concept of quality assurance systems, Costs of quality, Statistical quality Control (SQC), Variables & Attributes, X, R, P & C - charts,

	Acceptance sampling, OC - curve, Concept of AOQL, Sampling plan - Single, Double & sequential, Introduction to TQM & ISO - 9000. • **Inventory control**: Inventory control models - Inventory control models - Economic order quantity (EOQ), Economic batch quantity (EBQ) with & without shortage, Purchase discounts, Sensitivity analysis, Inventory control systems - P,Q,Ss Systems, Service level, Stock out risk, determination of order point & safety stock, Selective inventory control - ABC, FSN, SDE, VED and three dimensional, Numericals. • Conclusion of Unit including Real Life Application
3.	**Production Planning & Control**
	• Introduction of Unit • **Production Planning & Control**: Production Planning & Control: Introduction to Forecasting - Simple & Weighted moving average methods, Objectives & variables of PPC, Aggregate planning - Basic Concept, its relations with other decision areas, Decision options - Basic & mixed strategies, Master production schedule (MPS), Scheduling Operations, Various methods for line & intermittent production systems, Gantt chart, Sequencing – Johnson algorithm for n-Jobs-2 machines, n- Jobs-3 machines, 2 Jobs n-machines, n- Jobs m-machines Various means of measuring effectiveness of PPC, Introduction to JIT, Numericals. • • Conclusion of Unit
4.	**Manufacturing Cost Analysis**
	• Introduction of Unit • **Manufacturing Cost Analysis**: Fixed & variable costs, Direct, indirect & overhead costs, & Job costing, Recovery of overheads, Standard costing, Cost control, Cost variance Analysis - Labour, material, overhead in volume, rate & efficiency, Break even Analysis, Marginal costing & contribution, Numericals • Conclusion of Unit
5.	**Plant Layout and Material Handling**
	• Introduction of Unit • **Plant Layout and Material Handling**: Plant location, site selection- Plant layout types, need, factors influencing the layout - Tools and techniques for developing layout, process chart, flow diagram, string diagram, Template and Scale models- Layout Planning procedure- Assembly line balancing. Material Handling, scope and importance- Types of material handling systems-factors influencing material handling- methods of material handling. • **Material Requirements Planning (MRP)**: Introduction, MRP system structure, master production schedule (MPS), bill of materials, inventory status, MRP Procedure. • Conclusion of Unit

E. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1	Industrial Engineering and Management	Khanna O. P	Latest	Khanna publishers
2	Principles and practice of Management	Prasad, L.M.	Latest	Sultan Chand & Sons
3	Works Organisation& Management	Sushil Kumar Basu, K. C. Sahu, N. K. Datta	Latest	Oxford & IBH
4	Principles of Industrial Organization	Dexter S. Kimball	Latest	Read Books
5	Essentials of Industrial Management	Lawrence L. Bethel	Latest	McGraw-Hill.
6	Engineering Economics,	Riggs, J.L., Bedworth, D.J.	Latest	Tata McGraw-Hill.
Important Web Links				
1	https://nptel.ac.in/courses/112/107/112107142/			
2	https://nptel.ac.in/courses/112/107/112107292/			

Code: BMEEME5112	Finite Element Method	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the fundamentals and procedures of FEM for 1D, 2D, and 3D problems.	L2	PO1, PO2, PO3, PO5	PSO3
CO – 02	Analyze bar, beam, and truss elements using stiffness matrices and boundary conditions.	L3	PO1, PO2, PO3, PO5	PSO3
CO – 03	Model and solve 2D stress problems using CST and axisymmetric elements.	L2	PO1, PO2, PO4, PO5	PSO3
CO – 04	Apply FEM to steady-state heat transfer in 1D and 2D components.	L2	PO1, PO2, PO3	PSO3
CO – 05	Perform dynamic analysis using mass matrices, Eigen value analysis.	L2	PO1, PO2, PO3, PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	-	2	—	—	—	—	—	—	—	—	—	3
CO 2	3	3	2	-	2	—	—	—	—	—	—	—	—	—	3
CO 3	3	3	-	2	2	—	—	—	—	—	—	—	—	—	3
CO 4	3	2	2	-	-	—	—	—	—	—	—	—	—	—	3
CO 5	3	3	-	2	2	—	—	—	—	—	—	—	—	—	3
WT. AVG	**3.0**	**2.8**	**2.0**	**2.0**	**2.0**										**3.0**

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction of FEM	8
2.	Analysis of truss and beam using FEM	8
3.	Two-dimensional stress analysis using FEM	8
4.	Steady State Heat Transfer Analysis using FEM	8
5.	Dynamic Analysis using FEM	8

D. DETAILED SYLLABUS

Unit	Unit Details
1	**Introduction of FEM**
	• Introduction to unit • Introduction to Finite Element Methods: General Procedure - Engineering Applications - Stress and Equilibrium, Strain - Displacement relations. Stress - strain relations: Finite Elements: 1- Dimensional, 2 - Dimensional, 3-Dimensional & Interpolation Elements One Dimensional Problems: 1-D Linear and 1-D Quadratic Elements - Finite element modeling, Coordinates and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

	• Conclusion and Summary of Unit
2	**Analysis of truss and beam using FEM**
	• Introduction of Unit • Analysis of Trusses: Derivation of Stiffness Matrix for Plane Truss, Displacement of Stress Calculations. Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node beam element, Load Vector, Deflection. • Conclusion and Summary of Unit
3	**Two-dimensional stress analysis using FEM**
	• Introduction of Unit • Finite element modeling of two-dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Estimation of Load Vector, Stresses Finite element modeling of Axe-symmetric solids subjected to Axi-symmetric loading with triangular elements. Two dimensional four nodded Isoperimetric elements and numerical integration. • Conclusion and Summary of Unit
4	**Steady State Heat Transfer Analysis using FEM**
	• Introduction of Unit • Steady State Heat Transfer Analysis: one dimensional analysis of Slab, fin and two-dimensional analysis of thin plate. • Conclusion and Summary of Unit
5	**Dynamic Analysis using FEM**
	• Introduction of Unit • Dynamic Analysis: Formulation of finite element model, element - Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss and beam. Finite element - formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation. • Conclusion and Summary of Unit

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1.	Finite Element Methods: Basic Concepts and applications	Alavala	Latest	Prentice Hall International Edition
2.	Introduction to Finite Elements in Engineering	Ashok Chandrupatla	Latest	Pearson
3.	Practical Finite Element Analysis	Nitin S. Gokhale	Latest	Finite To Infinite
Important Web Links				
1	https://archive.nptel.ac.in/courses/112/105/112105308/			

Code: BMEEME5113	Product Design and Development	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Recall the importance of new product development	L1	PO5	PSO2
CO – 02	Understand the principles of morphology in design, conducting need analysis and problem formulation.	L2	PO2,PO4,PO5	PSO2
CO – 03	Apply various creative thinking techniques, such as brainstorming, analogy, and inversion, for concept generation..	L3	PO1,PO3,PO5,PO4	PSO2
CO – 04	Analyze the management aspects of new product development, including preliminary and detailed design.	L4	PO4	PSO2
CO – 05	Apply reliability considerations in product design, including the bath tub curve, failure rates, and spares optimization.	L3	PO1, PO3, PO5, PO4	PSO2

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-		**2**	—	—	—	—	—	—	—	-	**2**	-
CO 2	-	**3**	-	**2**	**2**	—	—	—	—	—	—	—	—	**3**	-
CO 3	**3**	-	**3**	**2**	**2**	—	—	—	—	—	—	—	—	**3**	-
CO 4	-	-	-	**2**	-	—	—	—	—	—	—	—	—	**2**	-
CO 5	**3**	-	**2**	**2**	**2**	—	—	—	—	—	—	—	—	**3**	-
WT. AVG	**3**	**3**	**2.5**	**2**	**2**									**2.6**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Product Design and Development	8
2.	Morphology of Design	7
3.	Generation of Alternatives and Concept Selection	7
4.	Management of New Product	7
5.	Reliability	7

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Product Design and Development**

	• **Introduction of Unit** • Importance of new product-Definition-importance-Development Process. Introduction to PDD, Applications, Relevance, Product Definition, Scope, Terminology. Design definitions, the role and nature of design, old and new design methods, Design by evolution. Examples such evolution of bicycle, safety razor etc. Physical reliability & Economic feasibility of design concepts. New product development process and organization. • Conclusion of Unit including real life applications
2.	**Morphology of Design**
	Introduction of Unit Need analysis- Problem Formulation: Establishing economic existence of need, Need Identification and Analysis, Divergent, transformation and convergent phases of product design. Design criteria, functional aspects. Aesthetics, ergonomics, form (structure). Shape, size, color. Mental blocks, Removal of blocks. Conclusion of Unit including real life applications
3.	**Generation of Alternatives and Concept Selection**
	Introduction of Unit Generation of Alternatives and Concept Selection: Concept generation- a creative process, Creativity, Road Elects to creative thinking-Fear of criticism and Psychological set. Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process. Brainstorming & Synectics. Morphological techniques. Utility concept, Utility value, Utility index. Decision making under multiple criteria. Economic aspects of design. •Conclusion of Unit including real life applications
4.	**Management of New Product**
	•Introduction of Unit Preliminary & detailed design- Design Review: Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility. Detailed design of subsystems, component design, Preparation of assembly drawings. Management of New Product – development and Launch: New Product Management's Challenges Maintaining focus, Promotion of Right Culture, Management of Creativity, Top Management attention.
5.	**Reliability**
	Introduction of Unit Reliability considerations, Bath tub curve, Reliability of systems in series and parallel. Failure rate, MTTF and MTBF. Optimum spares from reliability consideration. Design of displays and controls, Man-Machine interface, Compatibility of displays and controls. Ergonomic aspects. Conclusion of Unit including real life applications

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Book	Author	Edition	Publication
a. Reference Books				
1.	Product Design &Manufacturing	A.K.Chitab&R.C.Gupta	Latest	PHI (EEE).
2.	Product Design & Decision Theory	M.K. Starr	Latest	Prentice Hall
3.	Quality Control & Reliability Analysis	Bijendra Singh	Latest	Khanna Publications.
4.	The Technology of Creation Thinking	R.P. Crewford	Latest	Prentice Hall

5.	Engineering: An Introduction to Creativeprofession	G.C. BeakleyHw leach	Latest	Macmillan
6.	Industrial Design In Engineering – Amarriage of Techniques	Charles H .Flurscheim	Latest	The Design Council - London
b. Important Web links				
https://nptel.ac.in/courses/112/107/112107217/				

Code: BUACHM5228	PROFESSIONAL SKILLS-II	1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES: After Successful completion of the course students will be able to

CO	At the end of this course, learners will be able to:	Bloom Level
CO – 01	Learn how to update and manage the experience, education, and skills & expertise sections on social media & formulate appropriate updates as a means to promote business activities.	L3
CO – 02	Understand how to leverage grammar and formatting in formal documents & demonstrate how to follow the stages of the writing process.	L2
CO – 03	Evaluate presentation's weak spots and areas for improvement & learn, practice and acquire the skills necessary to deliver effective presentation with clarity and impact.	L5
CO – 04	Evaluate basic factors such as personal skills & abilities, career fields, willingness to learn and strengthen the chances to get desirable jobs.	L5
CO – 05	Understand negotiation and team skills dynamics and how to prepare for uncertainty & learn to craft agile strategy and be quick on your feet in changing circumstances.	L2

B. OUTLINE OF THE COURSE

Unit	Title of the unit	Time Required for the Unit (Hours)
1	Personal Branding	2
2	Professional Writing-II	8
3	Presentation Skills: Professional Setting	2
4	Job Interview & Group Discussion: Preparation by Mock Practice	4
5	Negotiation Skills, Team Management & Professional Awareness	8

C. DETAILED SYLLABUS

LIST OF LABS	
1.	Personal Branding: Its best practices
2.	Professional Writing II: Abstract Writing, Statement of purpose and other formal documents
3.	Expanding Professional Vocabulary
4.	Resume Building-II: Revising & Updating
5.	E-Learning & E-Content Development-II
6.	Presentation Skills in Professional Setting
7.	Job Interviews II: Preparation and Presentation for Mock Interviews
8.	Advanced Group Discussion-II: Analysis of professional GD Videos and Practices on Topics/Video/Article based topics
9.	Negotiation Skills & and Conflict Resolution-II
10.	Change and Transition Management

D. COs AND POs MAPPING

COs and POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO – 01	2	2	-	-	3	2	1	2	3	3	-	2
CO – 02	3	3	-	2	-	1	-	1	2	3	-	1
CO – 03	2	2	1	2	2	2	-	2	3	3	1	2
CO – 04	2	2	2	2	-	3	2	1	2	2	2	3
CO – 05	2	2	2	3	3	3	3	3	3	3	3	3

E. COs AND PSOs MAPPING

COs and PSOs	PSO1	PSO2	PSO3
CO – 01	2	3	2
CO – 02	3	2	1
CO – 03	2	3	2
CO – 04	2	2	3
CO – 05	3	3	3

Note: On the basis of mapping of LOs with POs, this course is related to Employability / Skill Development

SIXTH SEMESTER

Code: BMECME6102	AI/ML in Smart Manufacturing	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the capability of AI for production planning and decision making.	L3	PO1, PO2	PSO1
CO – 02	Understand the fundamental concepts of manufacturing scheduling and role of robot control system in manufacturing	L3	PO1, PO2, PO5	PSO1, PSO2
CO – 03	Realize application of Machine Learning to Industrial Planning and Decision Making	L3	PO1, PO2, PO4, PO5	PSO1, PSO2
CO – 04	Develop a practical understanding of effective scheduling.	L2	PO1, PO2, PO3, PO4	PSO1, PSO3
CO – 05	Develop Integrated Software System for Intelligent Manufacturing and Planning for Robot Control Systems in Manufacturing.	L2	PO1, PO2, PO3, PO5	PSO1, PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	—	—	—	—	—	—	—	—	3	-	-
CO 2	3	3	-	-	2	—	—	—	—	—	—	—	3	2	-
CO 3	3	3	-	2	2	—	—	—	—	—	—	—	3	2	-
CO 4	3	3	2	3	-	—	—	—	—	—	—	—	3	-	2
CO 5	3	3	2	-	2	—	—	—	—	—	—	—	3	-	2
WT. AVG	**3.0**	**2.8**	**2.0**	**2.5**	**2.0**								**3.0**	**2.0**	**2.0**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction of AI and ML	08
2	AI in Manufacturing	07
3	ML in manufacturing	07
4	Intelligent Automation	07
5	Industrial robot integrated with AI/ML	07

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction of AI and ML**
	• Introduction of Unit • Application of Machine Learning to Industrial Planning and Decision Making, Special Purpose Resource Design in Planning to Make More Efficient Plans, • Conclusion and Summary of Unit.
2.	**AI in Manufacturing**
	• Introduction of Unit • Geometric Reasoning Using a Feature Algebra, Backward Assembly Planning Symmetry Groups in Solid Model-Based Assembly Planning, An Expert System Approach for Economic Evaluation of Machining Operation Planning, Interactive Problem Solving for Production Planning, • Conclusion of Unit including Real Life application.
3.	**ML in manufacturing**
	• Introduction of Unit • An Abstraction-Based Search and Learning Approach for Effective Scheduling, • ADDYMS: Architecture for Distributed Dynamic Manufacturing Scheduling, An Architecture for Real-Time Distributed Scheduling, Exploiting Local Flexibility During Execution of Pre-computed Schedules • Conclusion of Unit including Real Life application
4.	**Intelligent Automation**
	• Introduction of Unit • An Architecture for Integrating Enterprise Automation; An Intelligent Agent Framework for Enterprise Integration; Teamwork Among Intelligent Agents: Framework and Case Study in Robotic Service • Conclusion of Unit including Real Life Application
5.	**Industrial robot integrated with AI/ML**
	• Introduction of Unit • Symbolic Representation and Planning for Robot Control Systems in Manufacturing; Integrated Software System for Intelligent Manufacturing; Enterprise Management Network Architecture: A Tool for Manufacturing Enterprise Integration; Design and Manufacturing: Integration through Quality • Conclusion of Unit including Real Life Application

E. RECOMMENDED STUDY MATERIAL:

Sr.No	Reference Book	Author	Edition	Publication
1.	Artificial Intelligence Applications in Manufacturing	A. Fazel Famili, Dana S. Nau , Steven H. Kim	Latest	AAAI Press
2.	The Future Computed: AI and Manufacturing; Global Lead, Manufacturing and Resources Industry	Çağlayan Arkan	Latest	Microsoft

ImportantWebLinks	
1	https://nptel.ac.in/courses/113104517
2	https://archive.nptel.ac.in/courses/112/103/112103280/

Code: BMECME6102	Refrigeration & Air Conditioning	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Recall and describe the fundamental principles of refrigeration.	L1,L2	PO2,PO4,PO5	PSO3
CO – 02	Understand the concepts of air refrigeration cycles and comprehend the classifications of aircraft refrigeration systems	L2	PO2,PO4,PO5	PSO3
CO – 03	Applying the knowledge gained to analyze and solve problems related to vapour compression refrigeration systems.	L3,L4,L5	PO1,PO3,PO4,PO5	PSO3
CO – 04	Analyze the differences between vapour absorption and compression systems.	L4	PO4	PSO3
CO – 05	Apply knowledge to evaluate and make decisions about various air-conditioning systems and their components.	L3,L5	PO1,PO3,PO4,PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1		2		2	2	—	—	—	—	—	—	—	-		2
CO 2		3		2	2	—	—	—	—	—	—	—	—		2
CO 3	3		2	3	2	—	—	—	—	—	—	—	—		3
CO 4				2		—	—	—	—	—	—	—	—		3
CO 5	2		2	2	2	—	—	—	—	—	—	—	—		2
WT. AVG	2.5	2.5	2	2.2	2										2.4

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Basics of Refrigeration	07
2.	Vapour Compression Refrigeration System	08
3.	Vapour Absorption Refrigeration System	07
4.	Air-conditioning systems	07
5.	Psychrometry and load Analysis	07

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Basics of Refrigeration**

	• Introduction of Unit • Refrigeration: Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & COP. • Air Refrigeration cycle: Open and closed air refrigeration cycles, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, reversed Brayton cycle, Brayton cycle with regenerative H.E. • Conclusion of Unit including real life applications
2.	**Vapour Compression Refrigeration System**
	• Introduction of Unit • Vapour Compression System: Single stage system, Analysis of vapour compression cycle, Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Multistage vapour compression system requirement, • Refrigerants: Classification of refrigerants, Nomenclature, Desirable properties of refrigerants, Common refrigerants, Secondary refrigerants and CFC free refrigerants. • Conclusion of Unit including real life applications.
3.	**Vapour Absorption Refrigeration System**
	• Introduction of Unit • Vapour Absorption system: Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Elementary idea of refrigerant absorbent mixtures, Temperature – concentration diagram & Enthalpy – concentration diagram , Adiabatic mixing of two streams, • Ammonia – Water vapour absorption system, Lithium- Bromide water vapour absorption system, Comparison. Electrolux Refrigerator • Conclusion of Unit including real life applications.
4.	**Air-conditioning systems**
	• Introduction of Unit • Air-conditioning systems: classification, system components, all air, all water, air water systems, room air conditioners, packaged air conditioning plant, central air-conditioning systems, split air conditioning systems. • Air conditioning system components: fans types, classification and selection, air cleaning devices classification, types, construction and working, humidifiers and dehumidifiers • Conclusion of Unit including real life applications
5.	**Psychrometry and load Analysis**
	• Introduction of Unit • Psychrometry: Psychometric properties, psychometric relations, pyschrormetric charts, psychrometric processes, cooling coils, By-pass factor and air washers. • Cooling load calculations: Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychrometric calculation for cooling, selection of air conditioning. • Conclusion of Unit including real life applications

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1	Refrigeration and Air Conditioning	CP Arora	Latest	TMH.
2	Refrigeration and Air Conditioning	. Sapali S.N.,	Latest	PHI Learning Private Ltd
3	Refrigeration and Air Conditioning	Manohar Prasad	Latest	New Age. International
4	Refrigeration and Air Conditioning	R.S. Khurmi& J.K Gupta	Latest	S.Chand
5	Refrigeration and Air-conditioning	Ramesh Arora ,	Latest	Prentice Hall of India,
6	A Course in Refrigeration and Air conditioning	SC Arora &Domkundwar	Latest	Dhanpatrai
7	Basic Refrigeration and Air- Conditioning	Ananthanarayanan	Latest	TMH
Important Web links				
1	https://nptel.ac.in/courses/112105128/			
2	https://beeindia.gov.in/			

Code: BMECME6103	Operation Research	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	**Analyze** the linear programming models and able to optimize the modeled problem by graphical approach and simplex method.	L4	PO1, PO2, PO11, P12	PSO2, PSO3
CO2	**Examine** and formulate the transportation and assignment problem and optimize by advance methods.	L4	PO1, PO2, PO11	PSO2, PSO3
CO3	**Analyze** the Queuing Theory and able to process n Jobs through 3 Machines, process of 2 Jobs through m machines, process n Jobs through m Machines.	L4	PO1, PO2, PO5, PO11	PSO2, PSO3
CO4	**Illustrate** game theory to solve complex problem like Rectangular game, Saddle point, Solution of games with saddle points, Rectangular games without saddle points, Dominance principle on m x 2 & 2 x n games.	L4	PO1, PO2, PO5, PO11	PSO2, PSO3
CO5	**Apply** the project management tools and utilize the concept of PERT and CPM to manage the complex project schedule.	L3	PO1, PO2, PO11, P12	PSO2, PSO3

B. MAPPING MATRIX OF CO,PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	2	2	-	2	2
CO2	2	3	-	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	-	-	2	-	-	-	-	-	2	-	-	2	2
CO4	2	3	-	-	2	-	-	-	-	-	2	-	-	2	2
CO5	2	3	-	-	-	-	-	-	-	-	2	2	-	2	2
WT. AVG	**2.2**	**2.6**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2.2**	**2**	**-**	**2**	**2**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1	Introduction and Linear programming problem	7
2	Transportation and Assignment problem	7
3	Queuing Theory and Sequencing problem	8
4	Theory of Games	7
5	PERT & CPM	7

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction and Linear programming problem**
	• Introduction of Unit • **Introduction to Operations Research**: Historical development, Main characteristics, phases, scope and limitations of Operations Research. • **Linear Programming**: Formulation of the problem, Graphical solution of LPP, Simplex method - slack, surplus and artificial variables. • Conclusion and Summary of Unit

2.	**Transportation and Assignment problem**
	• Introduction of Unit • **Transportation problem formulation:** unbalanced Transportation problem, Basic feasible solutions by Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: The stepping stone method and MODI method. • **Assignment problem formulation:** Hungarian method for optimal solution, unbalanced assignment problem. • Conclusion and Summary of Unit
3.	**Queuing Theory and Sequencing problem**
	• Introduction of Unit • **Queueing Theory**: Introduction of the queuing system, various components of a queueing system. Operating characteristics of a queuing system, Classification of Queuing models, simple queuing models, simple Numerical. • **Sequencing models**: Solution of Sequencing Problem, Processing of n Jobs through 2 Machines, Processing of n Jobs through 3 Machines, Processing of 2 Jobs through m machines, Processing n Jobs through m Machines. • Conclusion and Summary of Unit
4.	**Theory of Games**
	• Introduction of Unit • **Games Theory**: Introduction of Game theory, Rectangular game, Saddle point, Minimax (Maximin), • **Method of optimal strategies:** Value of the game, Two person-Zero sum game, Solution of games with saddle points, Rectangular games without saddle points, Dominance principle on m x 2 & 2 x n games. • Conclusion and Summary of Unit
5.	**PERT & CPM**
	• Introduction of Unit • **PERT and CPM**: Introduction to PERT (Project Evaluation and review Technique) and CPM (Critical Path method), Basic steps and techniques, Network Diagram Representation, Forward and Backward Pass- computation, Representation in Tabular form. Critical path calculation by network analysis, Determination of floats, Construction of time chart and resource labeling. • Conclusion and Summary of Unit

E. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1.	Introduction to Operations Research	Hillier F.S. and Lieberman G.J.	Latest	CBS Publishers.
2.	Operations Research	Taha H.A.	Latest	Pearson Education.
3.	Operations Research	Ravindran, Phillips and Solberg	Latest	Wiley India.
4.	Principles of Operations Research	Wagner H.M.	Latest	Prentice Hall of India
5.	Linear Programming and Network Flows	Bazaraa , Jarvis and Sherali	Latest	Wiley India.
6.	Operations Research	Gupta and Heera	Latest	S. Chand Publications
Important Web Links				
1	https://nptel.ac.in/courses/112106134/ and http://www.orcomplete.com/			

Code: BMECME6104	COMPUTER INTEGRATED MANUFACTURING	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the importance of CAM in manufacturing and its components.	L2	PO1, PO2	PSO3
CO – 02	Understand the part programming languages of conventional NC and CNC	L2	PO1, PO2, PO5	PSO3
CO – 03	Apply the computer aided process planning in manufacturing firm with group technology.	L3	PO1, PO2	PSO3
CO – 04	Examine the importance of production management system via computers in manufacturing.	L3	PO1, PO2	PSO3
CO – 05	Apply the manufacturing systems like FMS and Collaborative Engineering.	L3	PO1, PO2	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	-	-	—	—	—	—	—	—	—	—	-	-	**3**
CO 2	**2**	**2**	-	-	**2**	—	—	—	—	—	—	—	—	-	**3**
CO 3	**3**	**3**	-	-	—	—	—	—	—	—	—	—	—	-	**3**
CO 4	**3**	**2**	-	-	-	—	—	—	—	—	—	—	—	-	**2**
CO 5	**2**	**3**	-	-	—	—	—	—	—	—	—	—	—	-	**3**
WT. AVG	**2.6**	**2.4**			**2**									**2.8**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Computer Aided Manufacturing	08
2.	Part programming	08
3.	Computer Aided Process Planning	07
4.	Computer Aided Production Management Systems	08
5.	Computer Integrated Manufacturing Systems	07

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Computer Aided Manufacturing**

	• Introduction of Unit • **Introduction:** Overview of manufacturing processes, types of manufacturing systems, the product cycle, computer's role in manufacturing, sources and types of data used in manufacturing. • **The Beginning of CAM:** Historical Background, Basic components of NC systems, NC Procedure, NC coordinate system and machine motions, applications and economics of NC. • Conclusion of Unit including real life applications
2.	**Part programming**
	• Introduction of Unit • **Part programming-** manual and computer assisted such as APT Language. Computer Controls in NC Systems: Problems with conventional NC computer numerical control, Direct numerical control, combined CNC/ DNC systems, adaptive control machining system computer process interfacing, • Conclusion of Unit including real life applications
3.	**Computer Aided Process Planning**
	• Computer Aided Process Planning: Traditional Process Planning, Retrieval process planning system, Generative Process Planning, Machinability data system, computer generated time standards. • Group Technology: Introduction, part families, part classification and coding, coding system and machining cells. • Conclusion of Unit including real life applications
4.	**Computer Aided Production Management Systems**
	• Introduction of Unit • **Computer Aided Production Management Systems:** Introduction to computer aided PPC, Introduction to computer aided inventory management, manufacturing resource planning (MRPII), computer process monitoring and shop floor control, computer process control. Computer Aided Quality Control. • Non-contact inspection methods, optical and non-optical computer aided testing, Computer Aided Material Handling: Computer control on material handling, conveying, picking. • Conclusion of Unit including real life applications
5.	**Computer Integrated Manufacturing Systems**
	• Introduction of Unit • **Computer Integrated Manufacturing Systems:** Introduction, types special manufacturing systems, flexible manufacturing systems (FMS). • **Collaborative Engineering:** Introduction, Faster Design throughput, changing design approaches, extended enterprises, concurrent engineering, Agile and lean manufacturing. • Conclusion of Unit including real life applications

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1.	Automation, Production System and CIM	Groover, M.P.,	Latest	Prentice-Hall of India
2.	Computer Integrated Design and Manufacturing	David Bedworth	Latest	TMH, New Delhi
3.	Computer Integrated Manufacturing Systems	YoremKoren,	Latest	McGraw Hill,
4.	Computer Integrated Manufacturing	Ranky, Paul G	Latest	Prentice Hall International
5.	Design rules for a CIM system	R.W. Yeomamas	Latest	North Holland Amsterdam

Important Web Links	
1	https://nptel.ac.in/courses/112104289
2	https://www.sciencedirect.com/book/9780408007337/computer-integrated-manufacturing

Code: BMECME6105 ANCIENT INDIAN METALLURGY (As per IKS) 3 Credits [LTP: 3-0-0]

A. **COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING**

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	Understand the origin, process, and global relevance of Wootz steel and analyze its mechanical and microstructural properties	L2	PO1, PO2, PO4, PO5	PSO2
CO2	Explain the contributions of ancient Indian science and technology, including alchemy, to the field of metallurgy, and assess the influence of guild systems and foreign observations.	L2	PO1, PO2, PO4	PSO2
CO3	Describe ancient Indian mining practices, techniques, and key metallurgical regions and their archaeological significance.	L4	PO1, PO2, PO4, PO5	PSO2
CO4	Analyze traditional metalworking techniques and evaluate the mechanical properties and applications of metals and alloys like Panchaloha and Ashtadhatu.	L4	PO1, PO2, PO4, PO5	PSO2
CO5	Interpret the historical development of metal casting methods, study the apparatus used, and examine case studies such as the Iron Pillar of Delhi for metallurgical insight	L4	PO1, PO2, PO4, PO5	PSO2

B. MAPPING MATRIX OF CO, PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	2	1	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	1	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	-	3	2	-	-	-	-	-	-	-	-	2	-
CO4	2	3	-	2	1	-	-	-	-	-	-	-	-	2	-
CO5	2	2	-	2	1	-	-	-	-	-	-	-	-	2	-
WT. AVG	**2**	**2.4**	**-**	**2**	**1.25**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Wootz Steel-The Rise and Fall of a Great Indian Technology	8
2.	Indian Science and Technology Heritage	8
3.	Mining and Ore Extraction in Ancient India	8
4.	Metals and Metalworking Technology in India	8
5.	Casting, Iron, and Apparatuses in Metallurgical Practice	8

D. DETAILED SYLLABUS

Unit	Unit Details
1	**Wootz Steel-The Rise and Fall of a Great Indian Technology**

	• Introduction of Unit • Origin and characteristics of Wootz steel • Process of crucible steel making in India • Mechanical properties and microstructure • Historical accounts and global recognition (e.g., Damascus swords) • Decline of Wootz steel production and reasons • Conclusion of Unit including Real Life Application
2	**Indian Science and Technology Heritage**
	• Introduction of Unit • Overview of India's scientific contributions in metallurgy • Metallurgical knowledge in ancient Indian texts and inscriptions • European observers on the high quality and quantity of Indian iron and steel in the 18/19th centuries. • Contributions of Indian alchemy (Rasashastra) to metallurgy • Traditional craftsmen and guild systems • Conclusion of Unit including Real Life Application
3	**Mining and Ore Extraction in Ancient India**
	• Introduction of Unit • Mining and manufacture in India of Zinc, Iron, Copper, Gold, etc., from ancient times. • Major ore sources: gold (Kolar), zinc (Zawar), copper (Singhbhum) • Mining techniques: shaft mining, pit mining, fire-setting • Ore beneficiation and transport methods • Archaeological evidence of mining and processing centers • Conclusion of Unit including Real Life Application
4	**Metals and Metalworking Technology in India**
	• Introduction of Unit • Vedic references to metals and metal working. • Traditional smelting methods – furnaces, crucibles, and bellows • Blacksmithing, forging, alloying (bronze, brass, Panchaloha) • Classification and mechanical behavior of metals used • Tools, weapons, and structural components (beams, clamps, hinges) • Conclusion of Unit including Real Life Application
5	**Casting, Iron, and Apparatuses in Metallurgical Practice**
	• **Introduction of Unit** • Lost wax casting (Dhokra, Chola bronzes) – process and design • Apparatuses used in extraction: furnaces, retorts, tuyères, molds • The Iron Pillar of Delhi – corrosion resistance and metallurgical mystery • Role of artisans and scale of production in pre-modern India • **Conclusion of Unit including Real Life Application**

E. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1.	India's Legendary Wootz Steel: An Advanced Material of the Ancient World	Srinivasan, S. and Ranganathan, R.	Latest	National Institute of Advanced Studies (NIAS)
2.	Indian Science and Technology in the 18th Century	DHARAMPAL	Latest	Other India Press Mapusa 403 507 Goa, India
3.	The Archaeology of India's Metal and Alloy Technology	Agrawal, D.P.	Latest	Rupa & Co. / Aryan Books International
4.	The Saga of the Delhi Iron Pillar	Balasubramaniam, R.	Latest	Foundation Books / Universities Press
5.	Temples of South India and the Lost-Wax Technique	Rao, S. Balasubrahmanyam	Latest	Vakils, Feffer & Simons.
6.	History of Iron Technology in India: From the Beginning to Pre-Modern Times	Tripathi, Vibha	Latest	Indian Institute of Advanced Study
7.	Materials Characterization Techniques	S Zhang, L. Li and Ashok Kumar	Latest	CRC Press
Important Web Links				
1	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview			
2	https://archive.nptel.ac.in/courses/101/104/101104065/			

Code: BMECME6201	Computer Aided Engineering (CAE) Lab	1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	Perform 2D static analysis of structural elements like beams, trusses, and brackets.	L3	PO1, PO2, PO3, PO4, PO5,	PSO2, PSO3
CO2	Analyse the influence of material properties and cross-sections on simulation outcomes.	L4	PO1, PO2, PO3, PO4, PO5,	PSO2, PSO3
CO3	Conduct modal analysis to determine natural frequencies and mode shapes.	L3	PO1, PO2, PO4, PO5	PSO2, PSO3
CO4	Evaluate buckling and structural failure under different loading conditions.	L5	PO1, PO2, PO3, PO4, PO5	PSO2, PSO3
CO5	Analyse steady-state heat transfer through conduction and convection.	L4	PO1, PO2, PO3, PO4, PO5,	PSO2, PSO3

B. MAPPING MATRIX OF CO,PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	3	-	-	-	-	-	-	-	-	3	2
CO2	3	2	1	2	3	-	-	-	-	-	-	-	-	3	2
CO3	3	2	-	2	3	-	-	-	-	-	-	-	-	3	2
CO4	3	3	2	3	3	-	-	-	-	-	-	-	-	3	2
CO5	3	2	1	2	3	-	-	-	-	-	-	-	-	3	2
WT. AVG	**3**	**2.2**	**1.3**	**2.2**	**3**	-	-	-	-	-	-	-	-	**3**	**2**

C. LIST OF EXPERIMENT

Exp No.	Name of Experiment
1	2D static linear cantilever beam analysis with different sections, different materials for different loading conditions.
2	2D static analysis of truss structure for determining the deflection and stresses.
3	Static analysis of plate with a hole for determining the deformations and maximum stress distribution.
4	Static analysis of a rectangular L section bracket for determine the deformations and maximum stress distribution.
5	Modal analysis of beams for natural frequencies and mode shapes.
6	Modal analysis of shaft for natural frequencies and mode shapes.
7	Buckling analysis of a given specimen for static, fatigue and buckling failures.
8	Steady state conductive heat transfer analysis of a given specimen.
9	Steady state convective heat transfer analysis of a given specimen.
10	Steady state thermal analysis of heat sink with given initial conditions.

D. ONLINE RESOURCES

Important Web Links	
1	https://www.ansys.com/en-in/academic/learning-resources

Code: BMECME6202	Refrigeration & Air Conditioning Lab	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Recall and list the various elements of a mechanical refrigerator system through cut sections models or actual apparatus	L1,L2	PO2,PO4,PO5	PSO3
CO – 02	Understand the operations of an ice plant, and they should have acquired knowledge through a visit to a cold storage facility.	L2	PO2,PO4,PO5	PSO3
CO – 03	Applying their knowledge to study and perform tasks related to a domestic refrigerator.	L3	PO1,PO3,PO4,PO5	PSO3
CO – 04	Analyze and calculate/estimate the cooling load for a large building.	L4	PO4	PSO3
CO – 05	Develope the processes involved in winter and summer air conditioning through a visit to a central air conditioning plant.	L5	PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	**3**	-	**2**	**2**	—	—	—	—	—	—	—	-		**2**
CO 2	-	**3**	-	**3**	**2**	—	—	—	—	—	—	—	—		**3**
CO 3	**3**	-	**2**	**3**	**2**	—	—	—	—	—	—	—	—		**3**
CO 4			-	**3**	-	—	—	—	—	—	—	—	—		**3**
CO 5	-	-	-	-	**3**	—	—	—	—	—	—	—	—		**3**
WT. AVG	**3**	**3**	**2**	**3.5**	**2.25**										**2.8**

C. LIST OF EXPERIMENTS

1.	Study of various elements of a mechanical refrigerator system through cut sections models / actual apparatus.
2.	Study and performance of domestic refrigerator,
3.	Study of an Ice plant and visit to a cold storage for study.
4.	Calculation/ Estimation of cooling load for large building.
5.	To study basic components of cooling towers.
6.	Study of measuring instruments and various tools used in refrigeration and air-conditioning systems.

7.	To study basic components of desert coolers.
8.	To study basic components of air-conditioning system.
9.	Experiment on air conditioning test rig and calculation of various performance
10.	Study and performance of window type room air conditioner.

Virtual Lab
1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/refigeration/index.php
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/refigeration/labs/exp1/index.php

Code: BMECME6203	CNC PROGRAMMING LAB	1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Explain about the codes (G-code and M-Code) used in CNC machines for programming.	L2	PO1, PO2	PSO2, PSO3
CO – 02	Create part program for turning operation in CNC Machine.	L6	PO1, PO2, PO3, PO4, PO5	PSO2, PSO3
CO – 03	Design the part program for milling operation on CNC Machine.	L6	PO1, PO2, PO3, PO4, PO5	PSO2, PSO3
CO – 04	Produce part program for drilling operation on CNC Machine.	L4	PO1, PO2, PO3, PO4, PO5	PSO2, PSO3
CO – 05	Demonstration of CNC machine with user interface.	L3	PO1, PO2, PO3	PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	-	-	**2**	—	—	—	—	—	—	**2**	-	**3**	**2**
CO 2	**3**	**2**	**2**	**2**	**3**	—	—	—	—	—	—	**2**	—	**2**	**3**
CO 3	**3**	**2**	**2**	**2**	**3**	—	—	—	—	—	—	**2**	—	**3**	**3**
CO 4	**3**	**2**	**2**	**2**	**3**	—	—	—	—	—	—	**2**	—	**3**	**3**
CO 5	**2**	**2**	**2**	-	**2**	—	—	—	—	—	—	**2**	—	**2**	**3**
WT. AVG	**2.8**	**2**	**2**	**2**	**2.8**							**2**		**2.6**	**2.8**

C. LIST OF EXPERIMENTS

1	To study the characteristic features of CNC machine
2	To prepare part programming for plain turning operation.
3	To prepare part programming for turning operation in absolute mode.
4	To prepare part program in inch mode for plain turning operation.
5	To prepare part program for slot milling operation.
6	To prepare part program for drilling operation.
7	To prepare part program for multiple drilling operation in Z-axis.
8	Write the CNC Milling part programming for a given geometry using tool radius compensation.
9	To prepare CNC Milling part program for a drilling of holes using pack drilling cycle and repeat loop feature
10	Demonstration of CNC milling machine with user interface and calculation of coordinates of given geometry in absolute & incremental mode of cutter path.
Virtual Lab	
1	http://vlabs.iitkgp.ac.in/cim/#

Code: BMECME6204	Electric Vehicle and Drone LAB	1 Credit [L T P: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand and analyze various components of electric cars through case studies.	L2	PO1, PO2, PO5	PSO3
CO – 02	Conduct and interpret tests on EV batteries and charging systems.	L3	PO1, PO2, PO3, PO5	PSO3
CO – 03	Perform performance testing and simulations on electric vehicles.	L3	PO1, PO2, PO3, PO5	PSO3
CO – 04	Assemble, pilot, and control drones, both virtually and physically.	L3	PO1, PO2, PO3 PO4, PO5	PSO3
CO – 05	Model and simulate battery management systems (BMS) and state of charge (SOC) control for EVs.	L3	PO1, PO2, PO3 PO4, PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	2	-	–	1	–	–	–	–	–	–	–	–	–	2
CO 2	3	2	2	–	2	–	–	–	–	–	–	–	–	–	3
CO 3	3	3	2	2	3	–	–	–	–	–	–	–	–	–	3
CO 4	3	3	2	2	3	–	–	–	–	–	–	–	–	–	3
CO 5	3	3	2	2	3	–	–	–	–	–	–	–	–	–	3
WT. AVG	**2.8**	**2.6**	**2.0**	**2.0**	**2.4**										**2.8**

C. LIST OF EXPERIMENTS

1	Case studies on electric car components
2	EV Batteries Testing
3	EV charging interface, electronics & components testing
4	Performance testing of EV
5	Modeling and simulation of BMS for passive cell balancing in EV
6	State of charge (SOC) control of lithium ion battery simulation
7	Modeling and simulation to calculate electric vehicle speed from motor torque.
8	To use Drones on a virtual platform. Learning and practicing how to pilot the Drone.
9	Basic Drone assembly, flight and control.
10	Flying the drone using the provided basic controls. The controls work from software across a WIFI interface.

Code: BMECME6205	Computational Fluid Dynamics LAB	1 Credit [L T P: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand and utilize suitable software for modeling and simulation of aerodynamic problems.	L2	PO1, PO2, PO5	PSO2, PSO3
CO – 02	Apply explicit methods to solve one-dimensional wave and heat conduction equations.	L3	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 03	Generate algebraic and elliptic grids for numerical simulations.	L3	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 04	Perform numerical simulations of various aerodynamic flows including over an airfoil, wedge, and flat plate boundary layer.	L3	PO1, PO2, PO3 PO4, PO5	PSO2, PSO3
CO – 05	Perform numerical simulations of internal and external flows, such as laminar flow through a pipe and flow past a cylinder	L3	PO1, PO2, PO3 PO4, PO5	PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	-	–	1	–	–	–	–	–	–	–	–	-	2
CO 2	3	2	2	–	2	–	–	–	–	–	–	–	–	2	3
CO 3	3	3	2	–	2	–	–	–	–	–	–	–	–	3	3
CO 4	3	3	2	2	3	–	–	–	–	–	–	–	–	3	3
CO 5	3	3	2	2	3	–	–	–	–	–	–	–	–	3	3
WT. AVG	**2.8**	**2.4**	**2.0**	**2.0**	**2.2**									**2.7**	**2.8**

C. LIST OF EXPERIMENTS

1	Introduction to any one of the suitable software employed in modeling and simulation of aerodynamic problems.
2	Solution of one-dimensional wave equations using explicit method of lax
3	Solution of one-dimensional heat conduction equation using explicit method
4	Generation of the algebraic grids
5	Generation of the elliptic grids
6	Numerical simulation of the flow over an airfoil
7	Numerical simulation of the supersonic flow over a wedge
8	Numerical simulation of the flat plate boundary layer
9	Numerical simulation of the laminar flow through pipe
10	Numerical simulation of the flow past a cylinder

Code: BMEEME6111	TOTAL QUALITY MANAGEMENT	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Remembering Knowledge of Total Quality Management Concepts	L2	PO1, PO2, PO3	PSO1
CO – 02	Understand Strategic Quality Planning Principles	L2	PO1, PO2, PO3	PSO1
CO – 03	Apply Process Capability and Total Organizational Involvement	L3	PO1, PO2, PO3	PSO1
CO – 04	Apply Management Tools for Quality Improvement	L3	PO1, PO2, PO5	PSO1
CO – 05	Evaluate Defects Diagnosis and Prevention Strategies	L4	PO1, PO5	PSO1

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**1**	**2**	-	—	—	—	—	—	—	—	—	-	**3**	-
CO 2	**3**	**2**	**1**	-	—	—	—	—	—	—	—	—	—	**3**	-
CO 3	**3**	**1**	**2**	-	—	—	—	—	—	—	—	—	—	**3**	-
CO 4	**3**	**1**	-	-	**2**	—	—	—	—	—	—	—	—	**3**	-
CO 5	**3**	-	-	-	**2**	—	—	—	—	—	—	—	—	**3**	-
WT. AVG	**3**	**1.2**	**1.6**		**2**									**3**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Basics of Quality	07
2.	Economics of quality and measurement of the cost of quality	07
3.	Process control	08
4.	Acceptance sampling	07
5.	Emerging concepts of quality management	07

D. DETAILED SYLLABUS

Unit No.	Unit Details
1	Basics of Quality
	• Introduction of Unit • Quality: Introduction, definitions and history of quality control, Quality function and concept of quality circle, Quality policy and objectives. • Quality- The changing Business condition: The Quality Function; Managing for Quality; Quality policy; Quality circle; Perspective on Quality—Internal versus External. • Conclusion of Unit including real life applications
2	Economics of quality and measurement of the cost of quality
	• Introduction of Unit • Quality considerations in design: Cost of poor Quality; Categories of Quality Cost; Analysis of Quality costs; Economic models of Quality of conformance; Quality measurement in design, Quality Planning & Quality Control; Quality Improvement; Theories of motivation; Create and maintain awareness of Quality. • Conclusion of Unit including real life applications
3	Process control
	• Introduction of Unit • Process control: Use of control charts and process engineering techniques for use of control charts and process engineering techniques for implementing the quality plan, Definition and Importance of statistical process control; Statistical Control charts; Steps in setting up a control chart; Control chart for variables data; Process Capability; Estimating Inherent or potential Capability from a Control –chart analysis; Measuring process performance; Attribute Control Charts. • Conclusion of Unit including real life applications
4	Acceptance sampling
	• Introduction of Unit • Acceptance sampling of variables and statistical tolerance analysis: The concept of Acceptance Sampling; Economies of Inspection; Sampling Risk: The Operating Characteristic curve; Analysis of some Rule-of–Thumb Sampling; Quality Indices for Acceptance Plan; Types of Sampling Plan; Singleampling, Double Sampling and Multiple Sampling; Characteristic of a good Sampling Plan; Dodge-Roming Sampling Tables; Acceptance Sampling by Variables • Conclusion of Unit including real life applications
5	Emerging concepts of quality management
	• Introduction of Unit • Taguchi's concept of off-line quality control: Elements of TQM; Traditional versus modern quality management; Deming's philosophy; The Juran Philosophy; Strength and Weakness of Taguchi's ideas; Just In Time (JIT); benchmarking; Business Process Re-engineering (BPR); Supply Chain Management (SCM). Ishikawa's cause and effect diagram. • Conclusion of Unit including real life applications

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1	Quality Planning and Analysis	JM Juran and Gryna	Latest	McGraw Hill Education
2	Quality Control and Applications	Hansen & Ghare	Latest	PHI Learning Pvt Ltd
3	Industrial Engineering Management	O. P. Khanna	Latest	Dhanpat Rai Publications
4	Total Quality Management – An Introductory Text	Paul James	Latest	Prentice Hall
Important Web links				
1	https://archive.nptel.ac.in/courses/110/104/110104080/			

Code: BMEEME6112 UNCONVENTIONAL MACHINING PROCESSES 3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the importance and classification of unconventional machining.	L2	PO1, PO2	PSO3
CO – 02	Analys the various process parameters of mechanical energy techniques of unconventional machining.	L4	PO1, PO2, PO3	PSO3
CO – 03	Illustrate the operating principles of electrical energy techniques of unconventional machining.	L4	PO1, PO2, PO3	PSO3
CO – 04	Examine the parameters influencing metal removal through thermal energy of unconventional machining.	L4	PO1, PO2, PO3	PSO3
CO – 05	Illustrate the chemical and hybrid machining processes.	L4	PO1, PO2, PO3	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	-	-	—	—	—	—	—	—	—	—	-	-	**3**
CO 2	**2**	**3**	**2**	-	—	—	—	—	—	—	—	—	—	-	**3**
CO 3	**3**	**2**	**2**	-	—	—	—	—	—	—	—	—	—	-	**3**
CO 4	**2**	**3**	**2**	-	-	—	—	—	—	—	—	—	—	**1**	**3**
CO 5	**3**	**2**	**1**	-	—	—	—	—	—	—	—	—	—	-	**3**
WT. AVG	**2.6**	**2.4**	**1.5**											**3**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Unconventional Machining Methods	**07**
2.	Mechanical Energy Techniques	**08**
3.	Electrical Energy Techniques	**07**
4.	Thermal and Thermo-Electrical Energy Techniques	**09**
5.	Chemical and Hybrid Machining Techniques	**07**

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Unconventional Machining Methods**
	• Introduction of Unit • **Introduction:** Introduction to unconventional machining methods, need for unconventional machining, Sources of metal removal, Classification on the basis of energy sources, Parameters influencing selection of process. Limitations of conventional manufacturing processes, future possibilities. • Conclusion of Unit including Real Life Application
2.	**Mechanical Energy Techniques**
	• Introduction of Unit • **Abrasive Jet Machining (AJM):** Operating principles, Equipment, Parameters influencing metal removal, Applications, Advantages and Limitations. • **Water Jet Machining (WJM):** Operating principles, Equipment, Parameters influencing metal removal, Applications, Advantages and limitations. • **Ultra Sonic Machining (USM):** Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations. • Conclusion of Unit including Real Life Application
3.	**Electrical Energy Techniques**
	• Introduction of Unit • **Electro Chemical Machining (ECM):** Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations, Current developments in ECM. • **Electro Chemical Grinding (ECG):** Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations • Conclusion of Unit including Real Life Application
4.	**Thermal and Thermo-Electrical Energy Techniques**
	• Introduction of Unit • **Thermal Energy Techniques** Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations of Electron Beam Machining (EBM), Plasma Arc Machining (PAM) and Laser Beam Machining (LBM). • **Thermo-Electrical Energy Techniques** Electrical Discharge Machining (EDM) and Wire Cut Electrical Discharge Machining (WCEDM): Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations. Electrical Discharge Grinding (EDG): Operating principles, Equipment and sub systems, Parameters influencing metal removal, Applications, Advantages and limitations. • Conclusion of Unit including Real Life Application
5.	**Chemical and Hybrid Machining Techniques**
	• Introduction of Unit • **Chemical Machining:** Elements of the process: Resists (maskants), Etchants. Types of chemical machining process- chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process. • **Hybrid Machining Processes:** Concept, classification, process capabilities, and applications of various hybrid machining methods based on USM, EDM, ECM, etc. • Conclusion of Unit including Real Life Application

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Book	Author	Edition	Publication
a.	**Reference Books**			
1.	Non-Conventional Machining	Mishra, P. K	Latest	The Institution of Engineers (India), New Delhi
2.	Nontraditional Manufacturing Processes	Garry F. Benedict	Latest	CRC Press
4.	Advanced Machining Processes	Jain Vijay K.	Latest	Allied
5.	A Text book of Production Engineering	Sharma, P. C	Latest	Text Book Series
6.	Modern Manufacturing Process	Pandey and Shan	Latest	Prentice Hall, New Jersey.
b.	**Websites**			

- https://archive.nptel.ac.in/courses/112/103/112103202/#
- https://archive.nptel.ac.in/courses/112/105/112105212/

Code: BMEEME6113	Renewable Energy Technology	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the basic concepts of energy, its sources, consumption patterns, and the importance of energy conservation and sustainable development.	L2	PO1, PO6, PO7	PSO1
CO – 02	Understand the principles, technologies, and applications of solar energy, including thermal and photovoltaic systems.	L2	PO1, PO6, PO7	PSO1
CO – 03	Understand the principles of wind energy conversion, types of wind machines, and their applications.	L2	PO1, PO6, PO7	PSO1
CO – 04	Explore the various forms of bioenergy, biomass resources, and conversion technologies.	L3	PO1, PO6, PO7	PSO1
CO – 05	Study the principles and applications of ocean and geothermal energy technologies.	L2	PO1, PO6, PO7	PSO1

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	-	-	-	—	**2**	**3**	—	—	—	—	—	**3**	—	-
CO 2	**3**	-	-	-	—	**2**	**3**	—	—	—	—	—	**3**	—	-
CO 3	**3**	-	-	-	—	**2**	**3**	—	—	—	—	—	**3**	—	-
CO 4	**3**	-	-	-		**2**	**3**	—	—	—	—	—	**3**	—	-
CO 5	**3**	-	-	-	-	**2**	**3**	—	—	—	—	—	**3**	—	-
WT. AVG	**3**					**2**	**3**						**3**		

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Fundamentals of Energy	08
2.	Solar Energy	07
3.	Wind Energy	07
4.	Bio – Energy	07
5.	Ocean and Geothermal Energy	07

D. DETAILED SYLLABUS

Units	Course Contents
1	**FUNDAMENTALS OF ENERGY**
	• Introduction of Unit • Introduction to Energy-Energy consumption and standard of living-classification of energy resources-consumption trend of primary energy resources-importance of renewable energy sources-energy chain-common forms of energy-advantages and disadvantages of conventional energy sources-salient features of nonconventional energy sources-environmental aspects of energy-energy for sustainable development-energy density of various fuels-availability of resources and future trends. Energy scenario in India – Overall production and consumption-Availability of primary energy resources: Conventional, Non-Conventional-Estimated potential and achievement-Growth of energy sector and its planning in india – Energy conservation: Meaning and importance. • Conclusion of Unit including Real Life Application
2	**SOLAR ENERGY**
	• Introduction of Unit • Introduction – Solar radiation at the earth's surface-Solar Radiation measurements-Estimation of average solar Radiation. Solar energy collectors- Classifications-Flat plate collectors-Concentrating collectors-Comparison. Solar water heaters-Solar industrial heating system – Solar Refrigeration and Air-Conditioning Systems-Solar cookers-Solar furnaces- Solar greenhouse-Solar Distillation-Solar pond Electric power plant-Distributed Collector- Solar thermal Electric power plant. Principles of photovoltaic conversion of solar energy – types of solar cells – solar Photo Voltaic applications. • Conclusion of Unit including Real Life Application
3	**WIND ENERGY**
	• Introduction of Unit • Introduction-Basic principles of wind energy conversion: Nature of the wind, power in the wind, forces on the blades and wind energy conversion-wind data and energy estimation-site selection-classification of wind energy conversion systems-Advantages and Disadvantages-Types of wind machines-Horizontal axis machine-Vertical axis machine-Generating system-Energy Storage– Application of wind energy-Safety and environmental aspects. • Conclusion of Unit including Real Life Application
4	**BIO – ENERGY**
	• Introduction of Unit • Introduction – photo synthesis – usable forms of bio mass, their composition and fuel properties-Biomass resources – Biomass conversion technologies – Urban waste to energy conversion – Biomass gasification – biomass liquification – biomass to ethanol production – Biogas production from waste Biomass – types of bio gas plants - applications – Bio diesel production – Biomass energy programme in India. • Conclusion of Unit including Real Life Application
5	**OCEAN AND GEOTHERMAL ENERGY**
	• Introduction of Unit • **OCEAN AND GEOTHERMAL ENERGY** Ocean energy resources – principle's of ocean thermal energy conversion (OTEC) – Methods of Ocean thermal electric power generation – Energy utilisation – basic principle of tidal power – components and operations of tidal power plant – Energy and Power forms of waves – Wave energy conversion devices. Geothermal Energy – Geothermal Sources – Prime movers for Geothermal energy conversion – Advantages and Disadvantages – Applications • Conclusion of Unit including Real Life Application

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1	Renewable Energy Resources	G.D. Rai	Latest	Khanna Publishers, 2019.
2	Renewable Energy Technologies: A Practical Guide for Beginners	Chetan Singh Solanki	Latest	PHI Learning, 2018.
3	Renewable Energy Engineering and Technology: Principles and Practice	V. V. N. Kishore	Latest	PHI Learning, 2017
4	Non Conventional Energy Sources and Utilisation	R.K. Rajput	Latest	S.Chand & Company Ltd
Important Web links				
1	https://www.youtube.com/watch?v=e0nkkKDjY50&list=PL3QMEfkolRFbGhXveCE7RFDBgY0_gRxkh&index=4&ab_channel=NOC18GE09			

Code: BMECME6301	MINOR PROJECT	2 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Demonstrate a sound technical knowledge of their selected project topic.	L3	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 02	Undertake problem identification, formulation and solution.	L2	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 03	Design engineering solutions to complex problems utilizing a systems approach.	L3	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 04	Communicate with engineers and the community at large in written an oral forms	L3	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 05	Demonstrate the knowledge, skills and attitudes of a professional engineer.	L2	PO1, PO2, PO3, PO5	PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	**1**	-	**1**	—	—	—	—	—	—	—	-	**3**	**3**
CO 2	**3**	**2**	**2**	-	**1**	—	—	—	—	—	—	—	—	**3**	**3**
CO 3	**3**	**2**	**2**	-	**1**	—	—	—	—	—	—	—	—	**3**	**3**
CO 4	**3**	**2**	**1**	-	**1**	—	—	—	—	—	—	—	—	**3**	**3**
CO 5	**3**	**2**	**1**	-	**1**	—	—	—	—	—	—	—	—	**3**	**3**
WT. AVG	**3**	**2**	**1.4**		**1**									**3**	**3**

C. DETAILED SYLLABUS

1. The Project group in seventh term will continue the project work in eighth term and complete project in all respect (assembly, testing, fabrication, tabulation, test result etc.)
2. The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by guide.
3. The guides should regularly monitor the progress of the project work.
4. The project work along with project report should be submitted as part of term work in eighth term on or before the last day of the eighth term
5. Project report must be submitted in the prescribed format only. No variation in the format will be accepted.
6. Assessment of the project for award of marks shall be done by the guide and a departmental committee.
7. The guide should be internal examiner for oral examination.
8. The external examiner should be from the related area of the concerned project. He should have experience at degree level / industry.
9. The evaluation at final oral examination should be done jointly by the internal and external examiners.

SEVENTH SEMESTER

Code: BMECME7201	INDUSTRIAL TRAINING SEMINAR - II	2 Credits [LTP: 0-0-4]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Apply the effective knowledge in report reading.	L3	PO1, PO2, PO3, PO4	PSO3
CO – 02	Examine well recognized research papers from reputed journals, conferences.	L4	PO1, PO2, PO3, PO4	PSO3
CO – 03	Analyze the method of searching of research paper.	L4	PO1, PO2, PO3, PO4	PSO3
CO – 04	Analyze the abstract and methodologies in the research paper	L2	PO1, PO2, PO3, PO4	PSO3
CO – 05	Illustrate the techniques to create a review paper.	L3	PO1, PO2, PO3, PO4	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	–	–	–	–	–	–	–	–	–	–	3
CO 2	3	2	1	1	–	–	–	–	–	–	–	–	–	–	3
CO 3	3	2	2	2	–	–	–	–	–	–	–	–	–	–	3
CO 4	3	1	1	1	–	–	–	–	–	–	–	–	–	–	2
CO 5	3	2	2	2	–	–	–	–	–	–	–	–	–	–	2
WT. AVG	**3**	**1.8**	**1.6**	**1.6**											**2.6**

OBJECTIVE: To expose engineering students to technology development at workplaces and appraise them regarding shop-floor problems. To provide practical experience in solving open ended problems in real work setting so as to cause transfer of college-based knowledge and skills to solve practical problems and thereby develop confidence in the students in the analysis, synthesis and evaluation of practical problems leading to creative thinking.

1. At the end of the VI semester each student would undergo Industrial Training in an industry/ Professional organization / Research Laboratory with the prior approval of the Head of Department and Training & Placement Officer,

2. Students shall be required to submit a written typed report along with a certificate from the organization and present a PPT based on the training.
3. Students shall be required to give the presentations in the allotted period about the training attended after 5th Semester.
4. The presentation and report of the Training shall be evaluated during this period (=2 hrs per week) by Board of Examiners to be appointed by the Faculty Coordinator-Training Seminar who will award the grades.

EIGHT SEMESTERS

Code: BMEEME8101 Six Sigma and lean manufacturing 3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand lean assessment and Six Sigma SIPCO, QFD	L2	PO2,PO3,PO4,PO5	PSO2
CO – 02	Apply the various Tools and Techniques of six sigma	L3	PO1,PO3,PO4, PO5	PSO2
CO – 03	Carry out Failure Mode Effect Analysis (FMEA).	L4	PO4	PSO2
CO – 04	Apply the Regression analysis, Hypothesis testing, ANOVA, Multivariate analysis	L3	PO1,PO3,PO4, PO5	PSO2
CO – 05	Apply the Evaluation and Continuous Improvement Methods for six sigma.	L3	PO1,PO3,PO4, PO5	PSO1

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	**2**	**2**	**3**	**2**	—	—	—	—	—	—	—	—	—	**1**
CO 2	**3**	-	**2**	**2**	**2**	—	—	—	—	—	—	—	—	—	**1**
CO 3	-	-	-	**2**	-	—	—	—	—	—	—	—	—	—	**1**
CO 4	**2**	-	**2**	**2**	**2**	—	—	—	—	—	—	—	—	—	**1**
CO 5	**2**	-	**2**	**3**	**2**	—	—	—	—	—	—	—	**3**	-	**1**
WT. AVG	**2.3**	**2**	**2**	**2.4**	**2**								**3**		**1**

C. **OUTLINE OF THE COURSE**

Unit No.	Title of the Unit	Time Required for the Unit (Hours)
1	Introduction to Six Sigma	07
2	Scope of Tools and Techniques	07
3	Six Sigma Methodologies	08
4	Six sigma process	07
5	Evaluation and Continuous Improvement Methods	07

D. DETAILED SYLLABUS

Unit	Contents
1.	**Introduction to Six Sigma**

	• Introduction of Unit • Lean metrics identify lean metrics; kaizen cloud identification in VSM; lean assessment. improving targets and benchmarks; Six Sigma SIPCO, QFD; voice of the customer, kano models, cost of poor quality (COPQ) • Conclusion of Unit
2.	**Scope of Tools and Techniques**
	• Introduction of Unit • Tools for definition – IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter -Tools for measurement – Check sheets, Histograms, Run Charts, Scatter Diagrams, Cause and effect diagram, Pareto charts, Control charts, Flow process charts, Process Capability Measurement, Tools for analysis – Process Mapping, Regression analysis, RU/CS analysis, SWOT, PESTLE, Five Whys, interrelationship diagram, overall equipment effectiveness, TRIZ innovative problem solving – Tools for improvement – Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis – Tools for control -Gantt chart, Activity network diagram, Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management. • Conclusion of Unit
3.	**Six Sigma Methodologies**
	• Introduction of Unit • Design For Six Sigma (DFSS),Design For Six Sigma Method – Failure Mode Effect Analysis (FMEA), FMEA process – Risk Priority Number (RPN)- Six Sigma and Leadership, committed leadership – Change Acceleration Process (CAP)- Developing communication plan – Stakeholder. • Conclusion of Unit
4.	**Six sigma process**
	• Introduction of Unit • Six sigma process – Measure phase, Six sigma tools (CTQ tree, Process capability calculation, Measurement system analysis using gauge R&R) – Measure phase, Six sigma process – analyze phase, Six sigma tools (Histogram, box plot, control chart, scatter chart, fish bone diagram, pareto analysis chart, interrelations diagram) – analyze phase, Six sigma special tools (Regression analysis, Hypothesis testing, ANOVA, Multivariate analysis), Affinity diagram, DOE. • Conclusion of Unit
5.	**Evaluation and Continuous Improvement Methods**
	• Introduction of Unit • Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S. • Conclusion of Unit

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1	The Six Sigma Handbook	Thomas Pyzdek and Paul A. Keller	2020	McGraw Hill
2	Six Sigma Quality Improvement with MINITAB	Henderson, G. R.	Latest	Wiley
3	The certified six sigma Green Belt Handbook	Roderick A. Munro and Govindarajan Ramu and Daniel J. Zrymiak	2017	ASQ Quality Press and Infotech Standards India Pvt. Ltd
4	The Certified Six Sigma Black Belt Handbook	T. M. Kubiak and Donald W. Benbow	Latest	Pearson Publication
Important Web links:				
1	https://onlinecourses.nptel.ac.in/noc20_mg19/preview			

Code: BMECME8102 Tribology and Maintenance Tribology & Maintenance 3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the aspects of friction, like laws, causes, types, measurements, etc., that cause the degradation of industrial components and be able to create appropriate solutions.	L2	PO1, PO2, PO3	PSO3
CO – 02	Understand wear mechanisms that bring surface degradation of industrial components and be able to find appropriate solutions.	L2	PO1, PO2, PO3	PSO3
CO – 03	Understand coating technique to prevent wear	L2	PO1	PSO3
CO – 04	Understand various surface-dependent engineering properties and surface-initiated engineering failures. It helps them to create solutions for various surface degradation phenomena through surface engineering.	L2	PO1, PO2, PO3	PSO3
CO – 05	Understand maintenance objectives, Functions and control to failure	L2	PO1	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	**1**	-	—	—	—	—	—	—	—	—	-	**3**	-
CO 2	**3**	**2**	**1**	-	—	—	—	—	—	—	—	—	—	**3**	-
CO 3	**3**	-	-	-	—	—	—	—	—	—	—	—	—	**3**	-
CO 4	**3**	**1**	**2**	-	-	—	—	—	—	—	—	—	—	**3**	-
CO 5	**3**	-	-	-	-	—	—	—	—	—	—	—	—	**3**	-
WT. AVG	**3**	**1.6**	**1.3**											**3**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Study of friction and lubrication	07
2.	Study of Wear	07
3.	Study of Coating Techniques	07
4.	Study of Surface Phenomena	08
5.	Maintenance and control	07

D. DETAILED SYLLABUS

Unit No.	Unit Details
1	**Study of friction and lubrication**
	● Introduction of Unit ● Defining Tribology, Tribology in Design, Tribology in Industry (Maintenance). Friction, Laws of friction, Friction classification, Causes of friction; Theories of Dry Friction; Friction Measurement; Stick-Slip Motion and Friction Instabilities. Defining Lubrication, Basic Modes of Lubrication, Properties of Lubricants, Lubricant Additives. ● Conclusion of Unit including real life applications
2	**Study of Wear**
	● Introduction of Unit ● Wear, Wear classification/types; Factors affecting wear; Measurement of wear; Theories of Wear; Cryogenic wear; Wear between solids; Wear between solid and liquid; Friction and wear of engineering materials, Friction and wear of metallic materials; Friction and wear of ceramic materials; Approaches to Friction Control and Wear Prevention ● Conclusion of Unit including real life applications
3	**Study of Coating** Techniques
	● Introduction of Unit ● Introduction to surface modification and coating techniques. Conventional surface modification methods like case hardening, Physical vapor deposition, Chemical vapor deposition, Electro/electroless deposition, Thermal Spraying. ● Conclusion of Unit including real life applications
4	**Study of Surface Phenomena**
	● Introduction of Unit ● Introduction to materials surface, importance of surface engineering, classification, and scope of surface engineering of Materials. Thermodynamics of surface, surface dependent engineering properties Common surface - initiated engineering failure; mechanism of surface degradation Role of microstructure and materials behavior in controlling the surface-dependent failure of components, ● Conclusion of Unit including real life applications
5	**Maintenance and control**
	● Introduction of Unit ● Objectives and Functions of maintenance. Factors influencing plant availability, Maintenance control, Maintenance Strategies, Organization for Maintenance. Failure Statistics: Breakdown time distributions, Running-in failures, Time independent failures, Wear-out failures, Failure Probability, Survival Probability and age specific failure rates. ● Conclusion of Unit including real life applications

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1	Engineering Tribology	Prasanta Sahoo	Latest	PHI Learning Pvt. Ltd.
2	Materials and Surface Engineering in Tribology	Jamal Takadoum	Latest	John Wiley & Sons
3	Tribology of Ceramics and Composites A Materials Science Perspective	, Bikramjit Basu, Mitjan Kalin	Latest	John Wiley & Sons

4	Friction, Wear, Lubrication: A textbook in Tribology	Kenneth C Ludema Layo Ajayi	Latest	CRC Press
5	Maintenance, Replacement and Reliability	AKS JARDINE	Latest	Pitman publishing Co
Important Web links				
	https://www.youtube.com/watch?v=aoWBUhlN3-0&list=PLbMVogVj5nJRCfyN1QEiBsNFek8d00kWw&ab_channel=nptelhrd			

Code: BMECME8201	Energy Audit Lab	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understood and acquired fundamental knowledge on the science of energy and on both the conventional and non-conventional energy technologies	L1, L2	PO2, PO4, PO5	PSO3
CO – 02	Acquired the expertise and skills needed for the energy monitoring, auditing and management, and for the development, implementation, maintenance and auditing of Energy Management Systems	L2	PO2, PO4, PO5	PSO3
CO – 03	Become capable of analysis and design of energy conversion systems	L2	PO2, PO4, PO5	PSO2
CO – 04	Acquired skills in the scientific and technological communications, and in the preparation, planning and implementation of energy projects	L4	PO4	PSO3
CO – 05	Apply renewable energy system for energy saving, wind mill, solar PV installations.	L3	PO1, PO3, PO4, PO5	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	—	**3**	—	**2**	**2**	—	—	—	—	—	—	—	-	-	**2**
CO 2	—	**2**	—	**3**	**2**	—	—	—	—	—	—	—	—	-	**3**
CO 3	—	**3**	—	**3**	**2**	—	—	—	—	—	—	—	—	**2**	-
CO 4	—	--	—	**2**	-	—	—	—	—	—	—	—	—	-	**3**
CO 5	**3**	-	**3**	**2**	**2**	—	—	—	—	—	—	—	—	-	**2**
WT. AVG	**3**	**2.6**	**3**	**2.4**	**2**									**2**	**2.5**

C. LIST OF EXPERIMENTS

1.	Energy definition and understanding, Energy scenario of India and world, energy crisis, relation of energy in development of country. Energy and environment.
2.	Global protocols for energy conservation Kyoto protocol, Montreal protocols, Aarhus conversion.
3.	Energy auditing need and scope, relation of energy and environment, energy consuming sectors, energy saving effects on environment and quality of life.
4.	Types of energy audits, preliminary audit and detailed audit, heat audit and electrical audit Lighting audit, HVAC systems, automobile, ventilation practice and codes.

5.	Instrumentation in energy audit, instruments and their usages
6.	Detailed electric audit, inductive load, power factor, motors, variable speed drives.
7.	Detailed heat audit, application of thermodynamics and heat transfer principles, heat exchangers
8	Detailed lighting and ventilation systems audit, energy conserving measures. ISLE
9.	Renewable energy systems and its application for energy savings. Windmills, solar PV Installation.
10.	Energy auditing in buildings, green building zero energy building (Case study)

Code: BMECME8202	Academic Research Paper Writing and IPR	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Improvement common grammar and style errors in a given passage.	L3	PO1, PO9, PO10	PSO1
CO – 02	Delivering presentations with and without engaging elements to evaluate audience engagement.	L2	PO1,PO9,PO10	PSO1
CO – 03	Become capable of analysis and design of energy conversion systems	L2	PO1,PO9,PO10	PSO1
CO – 04	Exchanging papers or presentations for peer review and providing feedback.	L2	PO1,PO9,PO10	PSO1
CO – 05	Self-evaluation of papers or presentations before receiving external feedback and discussing strategies for improvement.	L3	PO1,PO9,PO10	PSO1

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	–	**3**	–	**2**	**2**	–	–	–	–	–	–	–	-	-	**2**
CO 2	–	**2**	–	**3**	**2**	–	–	–	–	–	–	–	–	-	**3**
CO 3	–	**3**	–	**3**	**2**	–	–	–	–	–	–	–	–	**2**	-
CO 4	–	--	–	**2**	-	–	–	–	–	–	–	–	–	-	**3**
CO 5	**3**	-	**3**	**2**	**2**	–	–	–	–	–	–	–	–	-	**2**
WT. AVG	**3**	**2.6**	**3**	**2.4**	**2**									**2**	**2.5**

Rules and regulations:

1. Introduction to lab objectives and expectations.
2. Correcting common grammar and style errors in a given passage.
3. Analyzing the strength of arguments in an argumentative paper.
4. Delivering presentations with and without engaging elements to evaluate audience engagement.
5. Creating two sets of presentation slides to compare the effectiveness of well-designed vs. poorly designed visual aids.
6. Delivering presentations with and without audience interaction to assess its impact on engagement.
7. Exchanging papers or presentations for peer review and providing feedback.
8. Revising and improving papers or presentations based on received feedback.
9. Delivering impromptu presentations to evaluate quick thinking and organization skills.
10. Self-evaluation of papers or presentations before receiving external feedback and discussing strategies for improvement.

Code: BMECME8203	Programming in MATLAB	1 Credits [LTP: 0-0-2]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	**Understand** and **apply** modeling software to solve differential equations and plot mathematical functions effectively.	L2, L3	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO12	PSO1, PSO2, PSO3
CO2	**Analyze** and **evaluate** numerical methods for solving system equations and generating airfoil coordinates using modeling software.	L4, L5	PO1, PO2, PO5, PO8, PO9, PO10, PO12	PSO1, PSO2, PSO3
CO3	**Create** and **assess** programs to determine critical Mach numbers, generate drag polar graphs, and analyze shock wave flow characteristics.	L4, L5	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO12	PSO1, PSO2, PSO3
CO4	**Apply** software to **calculate** turbofan performance and analyze converging-diverging nozzle flow characteristics.	L3	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO12	PSO1, PSO2, PSO3
CO5	**Calculate** beam deflection, bending moment, shear force, buckling loads of columns, and displacements in bars under mechanical/thermal loads using software.	L3	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO12	PSO1, PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO3**
CO1	3	3	3	3	1	-	-	1	1	1	-	1	3	2	2
CO2	3	3	-	3	1	-	-	1	1	1	-	1	3	2	2
CO3	3	3	3	3	1	-	-	1	1	1	-	1	3	2	2
CO4	3	3	3	3	1	-	-	1	1	1	-	1	3	2	2
CO5	3	3	3	3	1	-	-	1	1	1	-	1	3	2	2
WT. AVG	**3**	**3**	**3**	**3**	**1**	**-**	**-**	**1**	**1**	**1**	**-**	**1**	**3**	**2**	**2**

C. LIST OF EXPERIMENTS

Exp. No.	Name of Experiment
1	Programs using mathematical functions and plotting functions.
2	Program to solve differential equations.
3	Program to solve system of equations using numerical methods.
4	Program to generate airfoil coordinates.
5	Program to find critical Mach number of an airfoil and to generate drag polar graph.
6	Program to find flow characteristics across shock waves.
7	Program to calculate the performance of turbofan.
8	Program to find the flow characteristics of a CD nozzle.
9	Program to calculate the deflection, bending moment, shear force in a beam.
10	Program to solve system of equations using numerical methods.

D. ONLINE RESOURCES

Important Web Links	
1	https://in.mathworks.com/
2	https://in.mathworks.com/products/matlab-online.html

Code: BMEEME8111	Industrial Internet of Things	3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

Course Outcomes (COs):	At the end of this course, learners will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO1	Explain the Applications/Devices, Protocols and Communication Models of IOT	L2	PO1, PO2, PO5, P12	PSO1, PSO2
CO2	Demonstrate small Mechanical Engineering IOT oriented applications using Sensors, Actuators, Microcontrollers and Cloud	L2	PO1, PO2, PO5, P12	PSO1, PSO2
CO3	Select commonly used IOT Simulation Hardware platforms	L2	PO1, PO2, PO5, P12	PSO1, PSO2
CO4	Application of Interfacing and Communication Technologies for IOT	L3	PO1, PO2, PO5, P12	PSO1, PSO2
CO5	Illustrate IOT Application Development and Security of IOT Ecosystem	L3	PO1, PO2, PO5, P12	PSO1, PSO2

B. MAPPING MATRIX OF CO, PO, & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	3	-	-	-	-	-	-	3	2	2	-
CO2	2	3	-	-	3	-	-	-	-	-	-	3	2	2	-
CO3	3	2	-	-	3	-	-	-	-	-	-	3	2	2	-
CO4	2	3	-	-	3	-	-	-	-	-	-	3	2	2	-
CO5	2	3	-	-	3	-	-	-	-	-	-	3	2	2	-
WT. AVG	**2.2**	**2.6**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**	**-**

C. OUTLINE OF THE COURSE

Unit No.	Title of the Unit	Time required for the Unit (Hours)
1.	Introduction to the Internet of Things (IoT)	7
2.	Sensors, Actuators and Microcontrollers	8
3.	IoT Simulation Environment Hardware platforms and Endpoint Interfacing	7
4.	Interfacing and Communication for Building IoT Applications	7
5.	IoT Application Development and Security of IoT Ecosystem	7

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to the Internet of Things (IoT)**
	• Introduction of Unit • Overview, History, Definition and Characteristics, Connectivity Terminologies, Building blocks, Types of technologies used in IoT System, Baseline Technologies (Machine-to-Machine (M2M) communications, Cyber-Physical-Systems (CPS)), IoT Vs M2M, IoT enabled Technologies, IoT Levels and Templates, Design Methodology, The Physical Design Vs Logical Design of IoT, Functional blocks of IoT and

	Communication Models/Technologies, Development Tools used in IoT, IoT Architecture and Protocols, Various Platforms for IoT, Real time Examples of IoT, Challenges in IoT, The process flow of an IoT application, Evolution of Connected Devices, Applications of IoT, IoT Enablers, Overview of Governance, Privacy and Security Issues. • Conclusion of Unit including Real Life Application
2.	**Sensors, Actuators and Microcontrollers**
	• Introduction of Unit • Measuring physical and virtual quantities in digital world, Overview of Sensors working, Analog Vs Digital Sensors, Wired Vs Wireless Sensors, Types of Sensors, Types of Converters • Types of Transducers and Actuator, Controlling Hardware, Types of Controller, Role of microcontroller as gateway to interfacing sensors and actuators, Microcontroller Vs Microprocessor, Type of microcontrollers in embedded System • Conclusion of Unit including Real Life Application
3.	**IoT Simulation Environment Hardware platforms and Endpoint Interfacing**
	• Introduction of Unit • **IoT supported Hardware platforms**: Introduction to IoT Simulation Environment and Devices (Raspberry Pi, Espressif Processors, Arduino), Architecture, Setup, IDE, Installation, Interfaces (serial, SPI, I2C), Programming with focus on interfacing for reading input from pins, connecting external gadgets/sensors/actuators, Controlling and Displaying Output, Libraries, Basics of Embedded C programming • **Interfacing:** Interfacing Input, Intermediate, Output and Display Sensors, Converters, Actuators, Controlling Hardware, Controllers and Network Devices, • **IoT Architecture:** Building architecture and Open source architecture (OIC), Main design principles and needed capabilities, An IoT architecture outline, Standards Considerations• Conclusion of Unit
4.	**Interfacing and Communication for Building IoT Applications**
	• Introduction of Unit • **Communication**: Overview and Working of Controlled Systems, Connectivity models - TCP/IP Vs OSI model, IoT Communication Models, IoT Communication APIs, Serial Vs Parallel Communication, Wires Vs Wireless Communication, their Technologies and Hardware • **IoT Communication Protocols**: Protocol Standardization for IoT, Role of M2M in IoT, M2M Value Chains, IoT Value Chains, M2M and WSN Protocols (SCADA and RFID) • **Physical Servers and Cloud Platforms**: Web server, Posting sensor(s) data to web server, Introduction to Cloud Storage models and Communication APIs Webserver, API Virtualization concepts and Cloud Architecture, Advantages and limitations of Cloud computing, IoT Cloud platforms, Cloud services • Conclusion of Unit
5.	**IoT Application Development and Security of IoT Ecosystem**
	• Introduction of Unit • **Application Protocols**: MQTT, REST/HTTP, SQL Back-end Application Designing (Designing with Apache, MySQL, HTML, CSS), Non SQL Back-end Application Designing (MongoDB Object Type Database, jQuery for UI Designing), JSON lib for data processing • **Security**: Need of security in IoT, Security & Privacy during development, Privacy for IoT enabled devices, IoT security for consumer devices, Security levels, protecting IoT devices, Security, Privacy and Trust in IoT-Data-Platforms • Conclusion of Unit

E. RECOMMENDED STUDY MATERIAL

Sr.No	Reference Book	Author	Edition	Publication
1	Internet of Things - A Hands-on Approach	Bahga, A. and Madisetti, V.	Latest	Universities Press
2	The Internet of Mechanical Things: The IoT Framework for Mechanical Engineers	Hajjaj, S S H. and Gsangaya, K. R.	Latest	CRC Press
3	The Internet of Things: Enabling Technologies, Platforms, and Use Cases	Raj, P. and Raman, A. C.	Latest	CRC Press

4	Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0	Veneri, G., Capasso, A.	Latest	Packt Publishing
5	The Internet of Things: Key Applications and Protocols	Hersent, O, Boswarthick, D., Elloumi, O.	Latest	Wiley
Important Web Links				
1	https://nptel.ac.in/courses/106105166			
2	https://www.udemy.com/internet-of-things-iot-for-beginners-getting-started/			

Code: BMECME8112 ERGONOMICS AND WORKPLACE DESIGN 3 Credits [LTP: 3-0-0]

A. COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Identify the need of ergonomics and ergonomics methods.	L2	PO1, PO2	PSO3
CO – 02	Illustrate the anthropometric measurements and analyzing body dimensions and proportions.	L3	PO1, PO2, PO3	PSO3
CO – 03	Apply the anthropometry details in designing of work areas, tools and equipment.	L3	PO1, PO2, PO3	PSO3
CO – 04	Identify risk factors for ergonomic injuries in various environments and activities.	L2	PO1, PO2, PO3	PSO3
CO – 05	Describe the principles and methodologies of simulation in ergonomic design.	L4	PO1, PO2, PO3, PO5	PSO2, PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	-	-	—	—	—	—	—	—	—	—	-	-	**2**
CO 2	**2**	**3**	**1**	-	—	—	—	—	—	—	—	—	—	-	**2**
CO 3	**2**	**3**	**2**	-	—	—	—	—	—	—	—	—	—	-	**2**
CO 4	**2**	**3**	**2**	-	-	—	—	—	—	—	—	—	—	-	**2**
CO 5	**3**	**2**	**1**	-	**1**	—	—	—	—	—	—	—	—	**2**	**2**
WT. AVG	**2.4**	**2.6**	**1.5**		**1**									**3**	

C. OUTLINE OF THE COURSE

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Introduction to Ergonomics	7
2.	The Human System	8
3.	Design of Work Areas, Tools, and Equipment	8
4.	Health and safety at work	8
5.	Simulation in Ergonomic Design	7

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Introduction to Ergonomics**

	• Introduction of Unit • Introduction to Ergonomics, Definition and History of Ergonomics. The evolution of Ergonomics, reasons to use ergonomics, micro- and macro- ergonomics, performing ergonomics, judging the effectiveness of ergonomics intervention. Trends in Industry That Impact Ergonomic Design. Ergonomic Methods- Field Studies, Experimental Simulation, Laboratory Experiment, Computer Simulation, Differences in Ergonomic Methods. • Conclusion and Summary of Unit
2.	**The Human System**
	• Introduction of Unit • The Skeletal Subsystem- The Extremities, Joint-Related Disorders. Muscle Contractions and Capabilities, The Role of Oxygen in Muscle Actions, Muscle Injuries and Disorders, Effects of Gender and Muscular Strength. • Anthropometry- Predicting the Stature of People, Estimating Body Dimensions, Predicting the Segment Mass of the Human Body. Anthropometric Data- Children and youths. • The Sensory Subsystems- The Visual Sensory Subsystem, Human Perception of Sound, Position and Motion Sensing. • Conclusion of Unit including real life applications.
3.	**Design of Work Areas, Tools, and Equipment**
	• Introduction of Unit • Applied Anthropometry- Drafting Templates, Computer Modeling Methods. Design of Work Areas and Stations- Traffic Areas, Workplace Dimensions and Layout Principles, Design of Seating. • Design of Tools and Equipment - Hands and Handedness: Some Initial Design Principles, Other Desired Properties of Grip Design, Other Features of Hand Tool Design. • Protective Equipment for the Operator- Safety Shoes, Helmets, Protective Gloves, Eye Protection and Spectacles, Hearing Protection. • Conclusion of Unit including real life applications.
4.	**Health and safety at work**
	• Introduction of Unit • Anthropometry of the hand, Fundamentals of handle design. Human factors in industrial safety: an overview. • Ergonomic injuries, Back injury at work, Work-related upper limb disorders, Lifting and handling. • Human Diversity- Sex differences, Ethnic differences, Growth and development, Ageing. • Ergonomics in the Home- The kitchen, The bathroom, The bedroom. • Conclusion of Unit including real life applications.
5.	**Simulation in Ergonomic Design**
	• Introduction of Unit • Simulation Versus Other Methods in Ergonomics. Essential Elements of Computer Simulation- Higher-Level Computer Languages, Computer Simulation in Ergonomics. • Cognitive Simulation- Production System Modeling of Cognitive Tasks, Temporal Simulation Using the Production System Model. Operator-in-the-Loop Simulation-Training Simulators, Ground Vehicle Simulators. • Conclusion of Unit including real life applications.

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Reference Book	Author	Edition	Publication
1.	Human Factors and Ergonomics for Engineers	Mark R. Letho	Latest	Lawrence Erlbaum Associates
2.	A Guide to Ergonomics of Manufacturing	Martin Helander	Latest	TMH
3.	Introduction to Ergonomics	Bridger, R.S.	Latest	McGraw Hill,
4.	Human Factors for Information usability	Shackel, B.Richardson	Latest	Cambridge University Press

		S		
5.	Bodyspace Anthropometry, Ergonomics and the Design of Work	Stephen Pheasant	Latest	Taylor and Francis
Important web links				
	https://nptel.ac.in/courses/107103085/			
	https://nptel.ac.in/courses/107103004/			

Code: BMEEME8113	RELIABILITY AND MAINTENANCE ENGINEERING	3 Credits [LTP: 3-0-0]

A. **COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING**

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to:	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Understand the fundamental concepts of reliability, importance, and applications in engineering and management.	L2	PO1, PO2	PSO3
CO – 02	Understand the various types of systems, including series, parallel, and mixed configurations.	L2	PO1, PO2	PSO3
CO – 03	Illustrate the real-world applications of reliability testing and spare parts management in various industries, such as aerospace, automotive, manufacturing etc.	L3	PO1, PO2, PO3	PSO3
CO – 04	Identify the standard maintenance procedures and industry best practices for performing corrective and preventive maintenance.	L2	PO1, PO2, PO3	PSO3
CO – 05	Execute the integration of predictive maintenance and non-destructive testing to enhance the maintenance strategies and improve equipment reliability.	L3	PO1, PO2, PO3	PSO3

B. MAPPING MATRIX OF CO, PO, & PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	-	-	—	—	—	—	—	—	—	—	-	-	**2**
CO 2	**2**	**3**	-	-	—	—	—	—	—	—	—	—	—	-	**2**
CO 3	**2**	**3**	**1**	-	—	—	—	—	—	—	—	—	—	-	**3**
CO 4	**2**	**3**	**1**	-	-	—	—	—	—	—	—	—	—	-	**3**
CO 5	**3**	**2**	**2**	-	-	—	—	—	—	—	—	—	—	-	**3**
WT. AVG	**2.4**	**2.6**	**1.3**												**2.6**

C. **OUTLINE OF THE COURSE**

Unit No.	Title of the unit	Time required for the Unit (Hours)
1.	Reliability	6
2.	Types and Improvements	8
3.	Testing and Management	8
4.	Introduction to Maintenance	8
5.	Maintenance and Testing	8

D. DETAILED SYLLABUS

Unit	Unit Details
1.	**Reliability**
	• **Introduction:** Definition of reliability, types of failures, definition and factors influencing system effectiveness, various parameters of system effectiveness. • **Reliability Mathematics:** Definition of probability, laws of probability, conditional probability, Bay's theorem; various distributions; data collection, recovery of data, data analysis Procedures, empirical reliability calculations. • Conclusion of Unit including Real Life Application
2.	**Types and Improvements**
	• Introduction of Unit • **Reliability:** Types of system- series, parallel, series parallel, stand by and complex; development of logic diagram, methods of reliability evaluation; cut set and tie set methods, matrix methods event trees and fault trees methods, reliability evaluation using probability distributions, Markov method, frequency and duration method. • **Reliability Improvements:** Methods of reliability improvement, component redundancy, system redundancy, types of redundancies-series, parallel, series - parallel, stand by and hybrid, effect of maintenance. • Conclusion of Unit including Real Life Application
3.	**Testing and Management**
	• Introduction of Unit • **Reliability Testing:** Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis, reliability test standards. • **Spare Parts Management:** Spare parts, features and categorization of spares, cost considerations, Techniques of cost reduction; Selective controls used in spare parts control; ABC analysis, FSN, XYZ, VED and other approaches. Inventory control of spares. • Conclusion of Unit including Real Life Application
4.	**Introduction to Maintenance**
	• **Introduction:** Maintenance Objectives and Functions; Maintenance organization and Administration of Maintenance Systems. Need of planned maintenance. Maintenance policies; Breakdown, time-based maintenance: Block replacement, age replacement and periodic replacement policy. • **Corrective and preventive maintenance.** Maintenance planning, Scheduled maintenance. Cost of maintenance versus Cost of equipment and production delays. Inspection: Inspection intervals, Inspection reports, card history system • Conclusion of Unit including Real Life Application
5.	**Maintenance and Testing**
	• Introduction of Unit • Predictive maintenance. Equipment wear records, standards. Equipment used in predictive maintenance. Computerized maintenance, Total Productive Maintenance. • Methods of condition monitoring, Non-destructive testing, Liquid Penetrate, Magnetic particles, Ultrasonic testing, and Vibration analysis. Oil analysis, Radiographic testing. • Conclusion of Unit including Real Life Application

E. RECOMMENDED STUDY MATERIAL:

Sr. No	Book	Author	Edition	Publication
a. Reference Books				
1.	Reliability Evaluation of Engineering and Systems	R.Billintan & R.N. Allan	Latest	Plenum Press.
2.	Reliability in Engineering and Design	K.C. Kapoor & L.R. Lamberson	Latest	John Wiely and Sons.
3.	Life Testing and Reliability Estimation	S.K. Sinha & B.K. Kale	Latest	Wiely Eastern Ltd.

4.	Probabilistic Reliability, An Engineering Approach	M.L.Shooman	Latest	McGraw Hill.
5.	System Reliability Engineering	G.H.Sandler	Latest	Prentice Hall.
b. Websitesre				
• https://archive.nptel.ac.in/courses/127/105/127105234/				

Code: BMECME8301	MAJOR PROJECT	10 Credits [LTP: 0-0-20]

A. **COURSE OUTCOMES AND THEIR RESPECTIVE MAPPING**

COURSE OUTCOMES (Cos)	At the end of this course, learner will be able to :	Bloom Level	PO Mapping	PSO Mapping
CO – 01	Demonstrate a sound technical knowledge of their selected project topic.	L3	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 02	Undertake problem identification, formulation and solution.	L2	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 03	Design engineering solutions to complex problems utilizing a systems approach.	L3	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 04	Communicate with engineers and the community at large in written an oral form	L3	PO1, PO2, PO3, PO5	PSO2, PSO3
CO – 05	Demonstrate the knowledge, skills and attitudes of a professional engineer.	L2	PO1, PO2, PO3, PO5	PSO2, PSO3

B. **MAPPING MATRIX OF CO, PO, & PSO**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**3**	**2**	**1**	**-**	**1**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	-	**3**	**3**
CO 2	**3**	**2**	**2**	**-**	**1**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**3**	**3**
CO 3	**3**	**2**	**2**	**-**	**1**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**3**	**3**
CO 4	**3**	**2**	**1**	**-**	**1**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**3**	**3**
CO 5	**3**	**2**	**1**	**-**	**1**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**—**	**3**	**3**
WT. AVG	**3**	**2**	**1.4**		**1**									**3**	**3**

D. DETAILED SYLLABUS

1. The Project group in seventh term will continue the project work in eighth term and complete project in all respect (assembly, testing, fabrication, tabulation, test result etc.)
2. The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by guide.
3. The guides should regularly monitor the progress of the project work.
4. The project work along with project report should be submitted as part of term work in eighth term on or before the last day of the eighth term
5. Project report must be submitted in the prescribed format only. No variation in the format will be accepted.
6. Assessment of the project for award of marks shall be done by the guide and a departmental committee.

7. The guide should be internal examiner for oral examination.
8. The external examiner should be from the related area of the concerned project. He should have experience at degree level / industry.
9. The evaluation at final oral examination should be done jointly by the internal and external examiners.